PMM

Precision Metal Molding

INCLUDING DIE CASTINGS MAGAZINE

DECEMBER
1955

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P1A091

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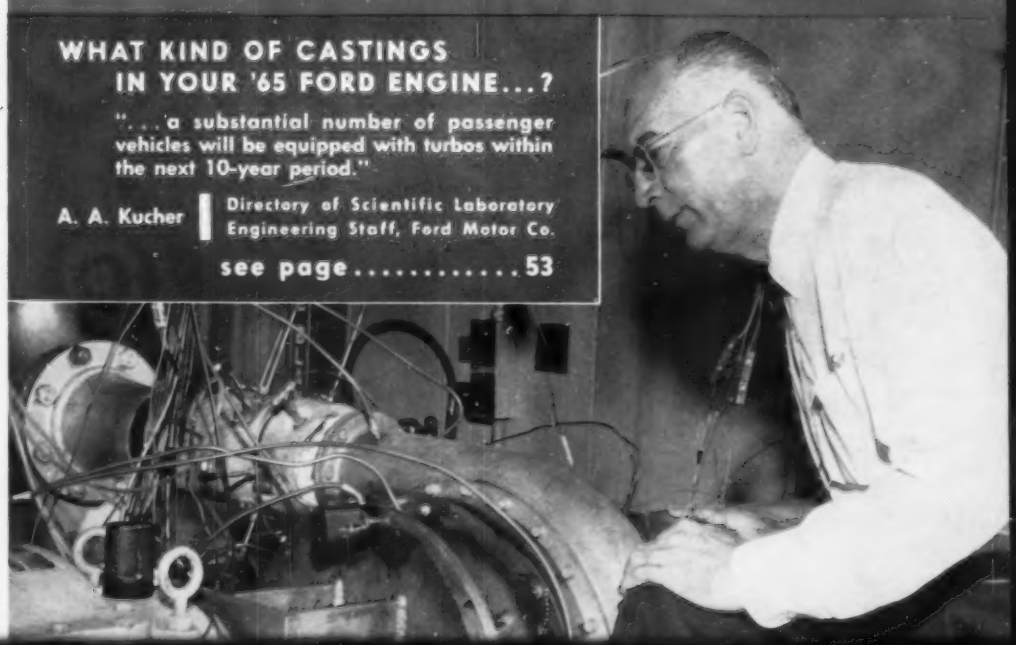
A. A. Kucher | Directory of Scientific Laboratory Engineering Staff, Ford Motor Co.

see page.....53



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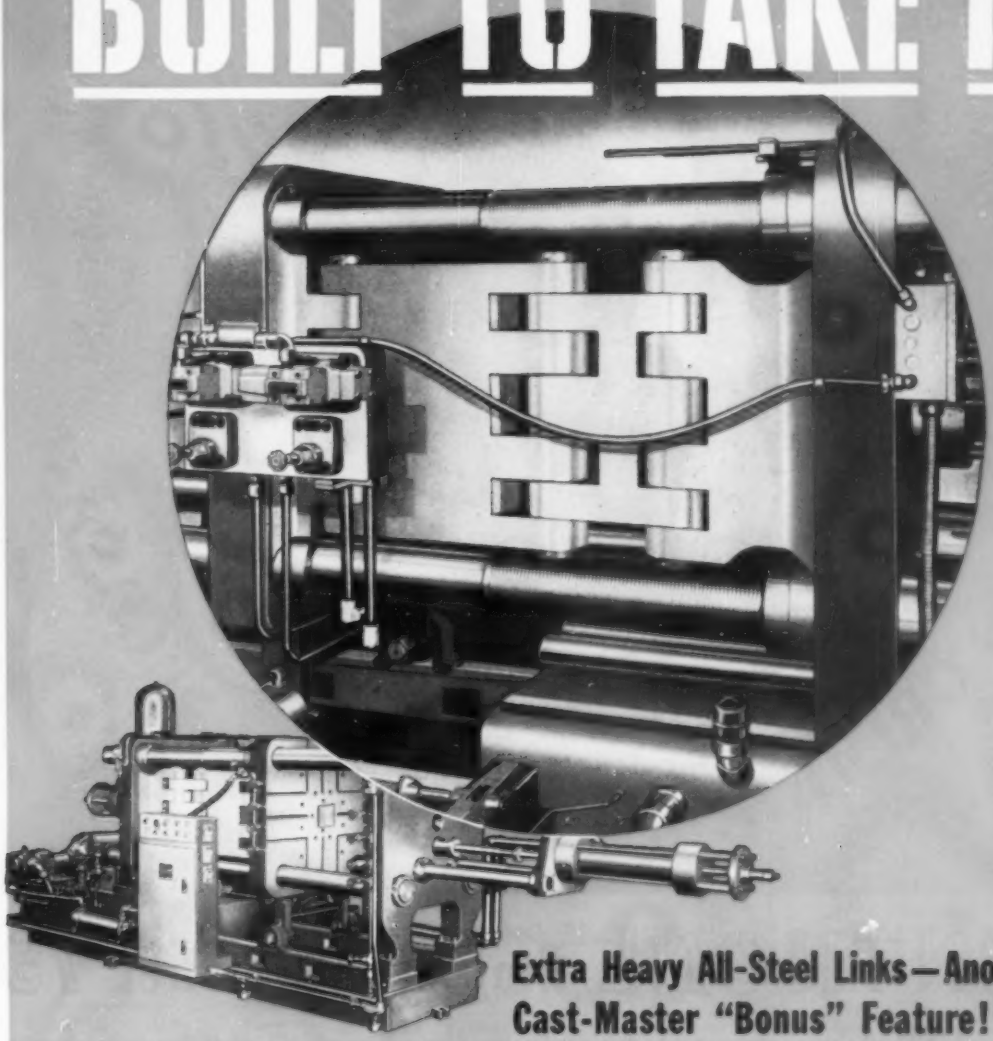

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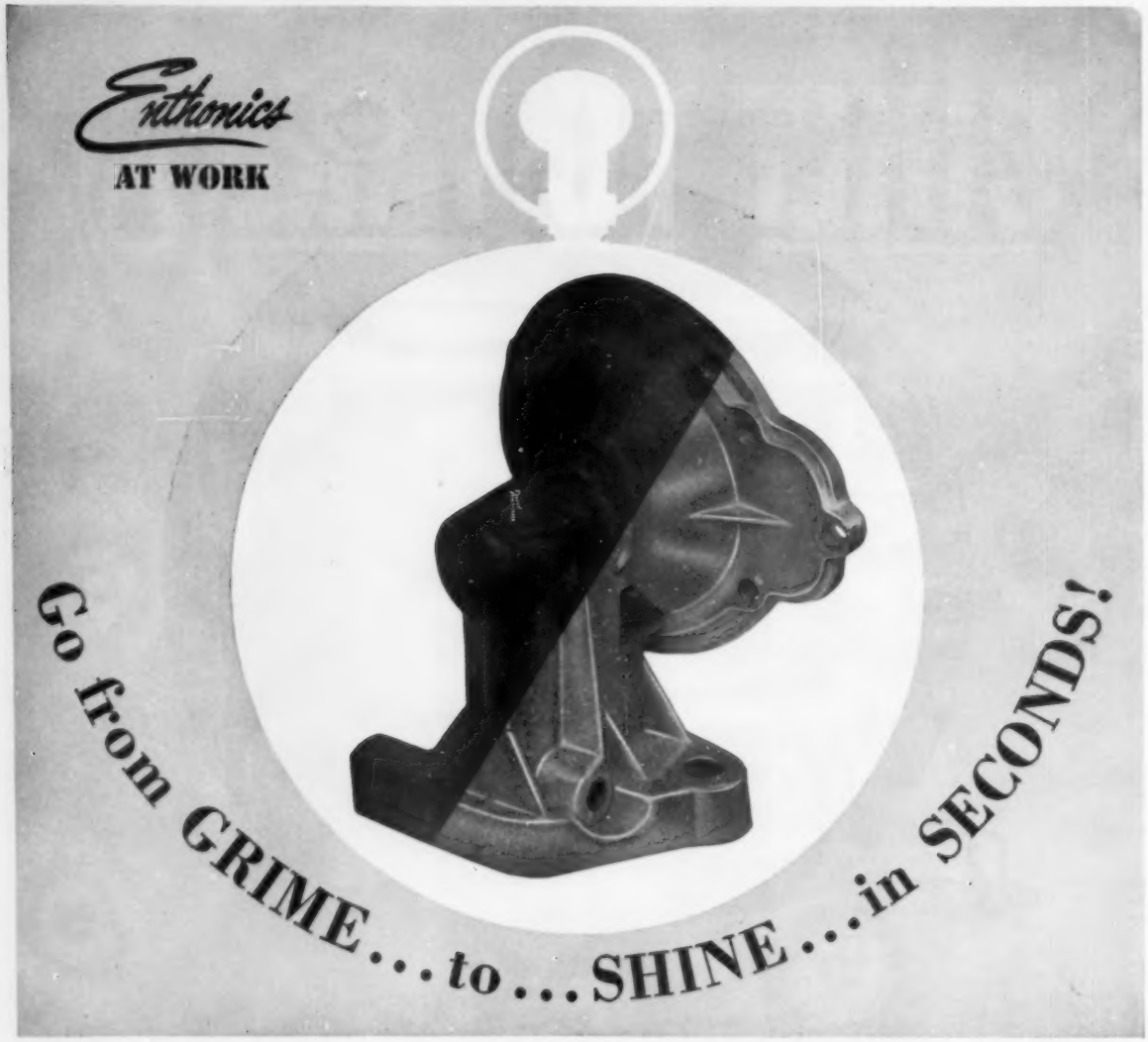

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PMM

Dec. 1955

Volume 13 Number 12

Precision Metal Molding

DIE CASTINGS
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PLASTER MOLD CASTINGS
PERMANENT MOLD CASTINGS
POWDER METALLURGY
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DIE CASTING REPORT

Uniformity -- Less Machining --- Corrosion Resistance -- Close Tolerances -- are a Few Reasons Why

This wringer-type Maytag washer has 24 die-cast parts.

Wringer parts include: gear case, cap and clutch pulley.

Maytag uses 15 to 20 million die cast parts per year!

Having produced over 9 million washing machines, no one knows better than Maytag Co. the importance of maintaining quality while meeting high production schedules. Die castings have helped solve the problem – at economical unit costs – by providing unlimited qualities of identical component parts. At the same time, aluminum and zinc die-castings have met the critical demands of functional applications. Examples of Maytag requirements. die castings must be (1) oil and water tight for gear cases and housings (2) true to dimension for line assembly with mating parts and (3) free and clear of external surface flaws.

While Maytag is a large user, those with lower requirements may enjoy similar economies and advantages. Let our creative design engineers look at your functional or decorative part needs, at no obligation of course.

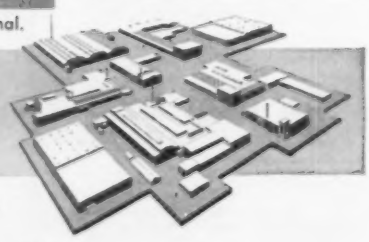
For a copy of: "Die-Castings Unlimited." Address: Precision Castings Company, Inc., 199 Walnut Street, Fayetteville, N. Y.

Formerly sandcast, this washer cover is now an aluminum die-casting.

Small zinc die-cast components, mostly functional.

Switched to die castings from sand castings

Many of the die-cast parts in the Maytag automatic and wringer-type washer were formerly sandcast. Less machining, better surface quality, reduced finishing time are reasons for the changeover. Precision is one of the major die-casting suppliers to Maytag...and has been since 1938.



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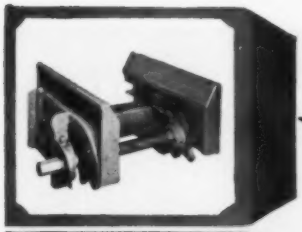

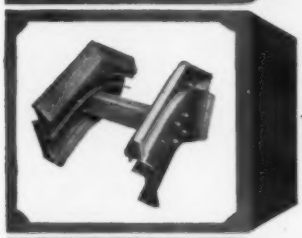

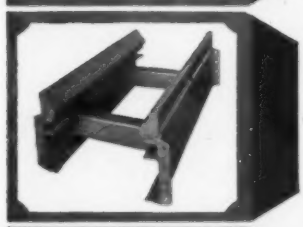

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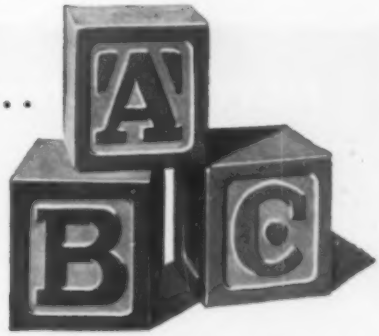

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A new 50-ton multiple-motion press offers increased economy to powder metal molders

Here is a powder metal press so new, so radically different from anything in the field today that it presents entirely new possibilities for efficient industrial compacting. With its simplified tooling and fast operation, the 640 press outdates all other designs; makes possible the application of powder metal to the production of parts for which the process has never before been considered economical.

The Stokes Model 640 is a completely new design, based on an intimate knowledge of the industry's requirements. It represents the latest achievement in Stokes 35-year experience in the design and manufacture of presses specifically for powder metallurgy.

For example, the 640 press is the first to give full, *50-ton simultaneous breakaway* on multiple lower punches, important in successful ejection of complex parts; *centralized controls*, for easy, fast set-up and operation; *independent adjustments* of all press actions while the machine is running; *direct-reading handwheel calibrations*, that eliminate guess-work on settings, permit exact records for each piece produced.

If you are now compacting powdered metals or are investigating how this economical process can be applied to your production, you should know about the many exclusive features of the Stokes Model 640 press. Write for Bulletin 670.

F. J. Stokes Machine Company
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The pieces shown are typical of parts for which the Model 640 press is particularly well suited. Difficult parts like these and pieces with double hubs, multiple levels and thin flanges all can now be made economically on the Stokes Model 640 press.

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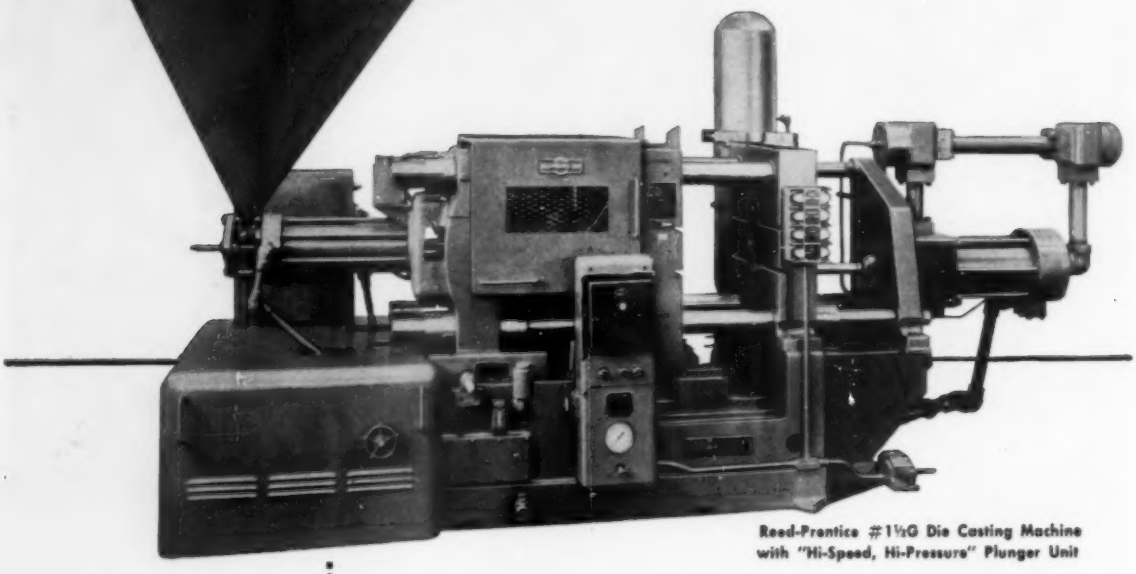
die stroke



Reed-Prentice #1½G Die Casting Machine
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free

Write for complete specifications and information on REED-PRENTICE die casting machines.

NOW REED-PRENTICE DIE CASTING MACHINES OFFER YOU Shorter Cycle Time, Higher Output

Here's a way to cut the time of each machine cycle where a full die stroke is not required. With this newest REED-PRENTICE feature, the adjustment for running thin dies is quick and easy. On Models #1½ and #1½G, the stroke adjusts from 6¼" to 10¼"; on Models #2 and #2G, from 8" to 14"

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BETWEEN THE LINES

THE DAY OF THE GAS TURBINE as a means of powering automobiles seems to be in the offing, if the speed with which major auto companies are pushing gas turbine development is any criterion. Such a change in the engine of tomorrow's cars will have an important effect upon the choice of materials and methods of manufacturing. In fact, one of the greatest problems in connection with building a practical turbine power unit is the development of fabricating methods which will produce an engine at cost comparable to that of the internal combustion engine. Tomorrow's gas turbine engine will have no cylinder block, pistons, crankshaft or carburetor . . . it will have, instead, turbine wheels, compressor, regenerator and burner, presenting an entirely different set of design factors. Where will the precision metal molding processes fit into the engine of tomorrow? A Ford researcher discusses this important topic beginning on page 54 of this issue. Also in this issue is a report on aircraft gas turbines by a metallurgist with Allison Division of GMC. Future issues of PMM will carry articles on other types and applications of precision cast turbines.

MAGNESIUM AS AN ENGINEERING MATERIAL in German automobiles also may be studied with vital interest by American car designers. The Volkswagen now uses 36 pounds of magnesium die and permanent mold castings for such major components as crankcase, transmission housing, gears and other parts. These lightweight autos that have an exceptionally high ratio of payload to vehicle weight present some interesting design problems. An engineer for the German firm discusses some of the specific problems, such as the difference in coefficient of thermal expansion and modulus of elasticity, presented by this new material, and the solutions found by his company. The discussion begins on page 40.

DESIGN POINTERS FOR POWDER METALLURGY that can save you money, simplify your tooling or expedite the delivery of powdered metal parts have been compiled by PMM with the assistance of several manufacturers of these parts. They are illustrated on pages 36-39 and should be worth careful study if your product contains any powdered metal components.

PROTECTIVE COATINGS suitable for application on zinc, aluminum and magnesium die castings under many conditions of exposure are introduced in a survey by PMM's editors in this issue, beginning on page 66. A tabulation of comparative performance, decorative effect, and method of application is a feature of the article.

PRECISION IN SYMMETRY can sometimes be as important as precision in dimensions or weight. One example of this is described here beginning on page 45, showing how a 17-pound stainless steel wedge gate for a 4" valve is designed. A shell mold casting has proved to be much more accurate, requiring less work to achieve a symmetrical wedge shape, than was possible by either forging or sand casting.

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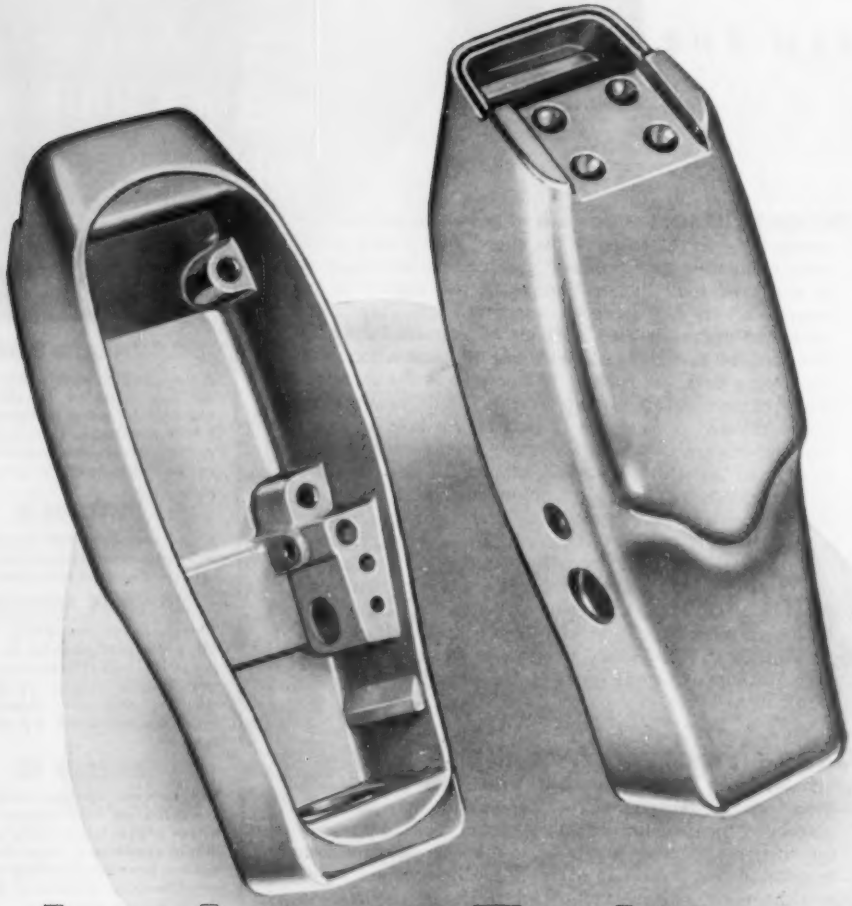

the Look and the Feel of excellence

with MADISON-KIPP

zinc and aluminum die castings

Die casting, as a process, has marked advantages in providing the "look" and the "feel" of excellence.

Seasoned skill, however, is involved in getting maximum process utilization as in the Madison-Kipp die cast Clipper Body here illustrated. It was developed with the double design power available when expert die designers cooperate in planning with product designers from the first rough sketch to final design.

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kipp

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• Skilled in Die Casting Mechanics • Experienced in Lubrication Engineering • Originators of Really High Speed Air Tools

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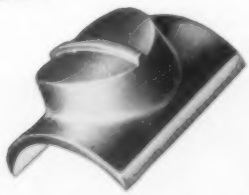
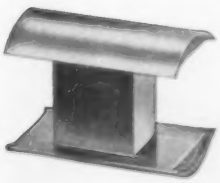
The striking difference in color shows comparative resistance to oxidation, proves superiority of RESISTOX Metal Powder (left) when exposed same length of time as ordinary powder.

Resistox Process gives Glidden Metal Powders more stability through greater resistance to oxidation!





Glidden Resistox Metal Powders offer you distinct storage and production advantages over ordinary metal powders because they resist oxidation from 5 to 10 times longer!

This exclusive Resistox Process permits storage over long periods of time without fear of oxidation, thus eliminating production and product-quality problems.

Glidden Resistox Metal Powders meet every requirement for uniformity, purity, consistency, strength. There is less material waste and die wear. They permit faster production of precision parts with greatly improved finish, appearance and performance characteristics.

Let us supply you with more complete information on these Glidden products: Resistox Copper and Lead Powders, Cuprous Oxide, Cupric Oxide and Cubond (Copper Brazing Paste). There's no obligation.

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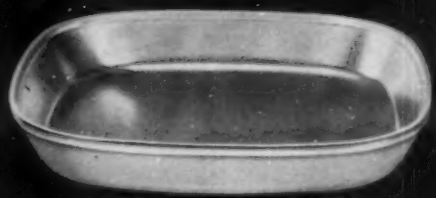

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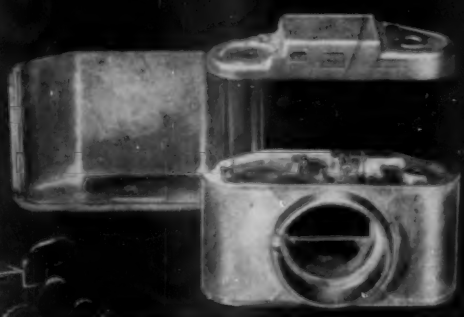

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Monarch pioneers in casting progress. Our casting and finishing facilities, unique in the industry, produce unusual casting performance. The job your casting must perform is economically accomplished with jobs we perform on the casting.

Illustrated are a few major industries capitalizing on Monarch's ability to guarantee top-value castings at factual, low end-cost.

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PIONEERS IN CASTING PROGRESS

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CASTING ABOUT

GOLDEN FUTURE FOR ALUMINUM is foreseen by many, taking their cue from the new Cadillac for 1956 which can be ordered with gold-dyed anodized aluminum grille and other trim elements. Two major aluminum producers, within a week, offered glowing estimates of the importance of this light weight metal in tomorrow's automobiles, pointing especially to the replacement of chromium plated trim with color-fast anodized aluminum.

Also, a major die caster, at the recent Metal Show in Philadelphia, displayed a one-piece die cast aluminum engine block. Doehler-Jarvis Div. of National Lead Company, which has carried out the development work in conjunction with Kaiser Aluminum & Chemical Company, made no claims as to performance or cost, but indicated that the first stage in development . . . the actual production of this large and intricate die casting . . . had been advanced to the point where they were willing to display a complete engine block casting.

Aluminum Company of America, whose Alumiliting process has been used to produce colorful, gold-dyed electrolytic finishes on the Cadillac grille and other trim as an optional feature, describe the coating as "a crystal clear, sapphire-hard coating of aluminum oxide that is actually part of the metal itself and will not peel or blister."

David P. Reynolds, sales vice president of Reynolds Metals Company, told Detroit engineers at an SAE meeting that aluminum, "sparkling in all the colors of the rainbow" will be commonplace on tomorrow's automobiles. He also predicted a trend toward aluminum auto roofs which would become an important element in styling now.

Since 1950, Mr. Reynolds said, applications of aluminum in automobiles have grown from five to 35 items, and the amount of aluminum in these applications has been increased four and one-half times.

Last month, PMM gave a complete outline of the method of color anodizing aluminum, reporting that a leading die casting engineer envisions the practical application of this technique on die castings in the not-so-distant future.

FLOOD SALVAGE is a new use for barrel finishing methods. According to Norton Company, a quick solution to the problem of removing dirt, rust and surface corrosion from loads of small, finished or semi-finished metal parts caught in the recent flood waters of New England, has been to process them in tumbling barrels. An hour or so in tumbling abrasive, clear water and suitable cleaner has restored these parts to their original condition.

Continued on next page

NEW...

- New low prices
- New improved design
- New stock sizes

in

Spincraft ladles

Available with or without handles — in stainless steel and mild steel.

If you pour non-ferrous alloys — now, more than ever, Spincraft ladles belong in your plant. You can select from 23 practical sizes (from ¼ lb. to 30 lb. capacity in molten aluminum) — in top quality stainless steel — for *less* than you've ever paid before.

And . . . experience shows new Spincraft ladles actually cost less to use. Here's why —

Reinforced cup bottom and pouring edge have been spun to a heavier gauge than the weight-saving side walls. This means you get easier handling, better heat transfer, and reduced "burnouts" for longer ladle life. Handles are "whack-proof". Cup surfaces are specially finished to hold any type of ladle coating longer.

Hand any operator a new Spincraft ladle — and the next day try to take it away from him! You'll see how the practical conical shape, the built-in overall balance, minimizes spillage as he "swings" from crucible to machine or mold. Notice how every motion takes less effort. And there's a reason: — for example — a Spincraft stainless steel ladle in the 65 cu. in. size weighs from 2 to 11 pounds *less* than conventional cast or malleable iron, forged or pressed steel ladles.

Order Spincraft ladles for your plant. Cut operator fatigue—pour more metal, for greater efficiency and profit.

Write today for new low prices. Special sizes, gauges, handles and materials will be quoted on request.

Spincraft
SKILL WILL DO IT
INCORPORATED

4131 W. State St., Milwaukee 8, Wis.

Circle No. 49 on Reader Service Card

For more information circle No. 64 on the Reader Service Card

...put SAFETY

in your hydraulic lines

...switch to

UCON Hydrolubes
Trade-Mark

For maximum fire-resistance, maximum protection for men and machines, change to UCON Hydrolubes—CARBIDE's safety hydraulic fluids. Severe, exhaustive laboratory tests and 7 years' industrial use have proved their resistance to burning.

UCON Hydrolubes are balanced formulations. They contain modern synthetic lubricants and anti-wear agents for lubricity, water for non-flammability, effective liquid and vapor phase corrosion inhibitors for the protection of your equipment, an anti-freeze to keep the pour-point low (below minus 55°F).

You don't have to revamp your equipment to change to UCON Hydrolubes. They have no harmful effects on packings and seals . . . are supplied in a range of viscosity grades . . . have high viscosity indexes (150 to 160) . . . present no toxicity problems.

Remember: **SAFETY** *is no accident . . . return the coupon today.*

UCON Hydrolubes *are products of . . .*
Trade-Mark

CARBIDE AND CARBON CHEMICALS

CARBIDE AND CARBON CHEMICALS COMPANY
A Division of Union Carbide and Carbon Corporation
30 East 42nd Street UCC New York 17, N. Y.

Please send me the booklet "UCON Hydrolubes," Form 7380.

Name_____

Company_____ Position_____

Address_____

"Ucon" is a registered trade-mark of Union Carbide and Carbon Corporation.

For more information circle 14 on the Reader Service Card

CASTING ABOUT
continued from page 13

PURE IRON TOROIDS using high density pressing techniques, are now being produced by a West Coast powder metallurgy firm to replace more expensive materials. Kwikset Powdered Metal Products in California reports that new pressing methods, new ductile materials and new type tooling permit higher densities than previously possible in mass production. The high permeability toroids used in many noise filter applications by the electronics industry, are reported to have several advantages: exceptionally good saturation values, ample radii to prevent damage to wire insulation, high mechanical strength to avoid breakage during winding and handling, uniform dimensions and properties from lot to lot, and a wide stability range.

MORE ACCURATE METERING of oxygen has been made possible in a piece of medical equipment manufactured by Puritan Compressed Gas Corp. of Kansas City, Mo., who are now using four certified zinc die castings in place of brass sand castings. Among drawbacks of the brass sand castings previously used for these flowmeters which must meet critical "life or death" requirements for administering oxygen to patients, were: 1) they were expensive to manufacture because of excessive machining; 2) they were not as attractive as desired; and 3) they developed back pressures due to inaccurate measurements of oxygen.

A brass tube, cast as an "insert" in the zinc die casting, saves an "impossible" job of machining and forms the main gas passage. Both internal and external surfaces of the zinc die castings are chromium plated.

The four die castings, produced in a single shot in a four-cavity die, are pressure tested at 150 psi. Essentially all gas channels and screw holes are formed in the casting process and have thus eliminated most machining.

How to produce a Laboratory Scale to sell for only $29.50

CASE HISTORIES FROM MT. VERNON FILES

Manufacture a laboratory balance as accurate, as fine-looking as this Ohaus Cent-O-Gram* — capacity 311 grams, sensitivity to .01 gram — to sell for only $29.50? Realistically, you'd have said it was impossible — but here it is!

To produce such an outstanding value in a precision instrument requires all the top level design and production abilities that can be mustered. The two principal parts of this balance — base and support brackets — were designed to obtain all the advantages of die casting: — thin wall sections of great strength and rigidity, negligible machining, high speed production, low cost.

And low cost means low first cost too; that's why Mt. Vernon has been a constant supplier to Ohaus for many years. From die cost to finished casting, Mt. Vernon has both the complete die casting service and the facilities it takes to produce parts like these at minimum cost in any quantity. We have 162,000 square feet of the most modern equipment for making dies and for die casting aluminum and zinc. Mt. Vernon service comprises completely coordinated designing, die-making, casting, and machining, all under one roof.

It will pay you to bring your production specifications to us. We may show you, as we did Ohaus, the way to important cost reductions and improved products.

MT. VERNON
DIE CASTING CORP.
STAMFORD, CONNECTICUT

*Manufactured by Ohaus Scale Corporation, Union, N. J.

to get any of the free materials described here, circle the appropriate number on the reader service cards bound into this issue

DATA OFFERED IN THIS MONTH'S ADS

2. BETTER ALUMINUM CASTINGS will result from the use of a dispersion of vermiculite in water as an insulating mold wash in permanent mold castings described in bulletin from Acheson Colloids.

3. CERTIFIED ZINC and precision aluminum die castings are the regular products of Advance Tool & Die Casting Co. as described in their newest brochure. Facilities for helpful design, engineering and production are reviewed.

4. HYDRAULIC PRESSURE HOSE for use with any fire resistant hydraulic fluid is fully described in Bulletin 157, published by Aeroquip Corp.

5. HIGH STRENGTH BRONZE permanent mold castings in intricate designs and with both close tolerances and excellent reproduction of detail are described in the new Alcaloy, Inc. catalog and literature.

8. DIE CASTING ALLOYS are the subject of a technical data booklet available from Apex Smelting Co.

9. LONG-LIFE PISTON RINGS of hardened steel for use in hot chamber die casting machines are described and illustrated, along with specifications and size lists, from Auto-Diesel Piston Ring Co.

11. POWDERED METAL PRESSES which incorporate the latest design features are described in new bulletin from Baldwin-Lima-Hamilton Corp.

13. ALLOYS FOR INVESTMENT CASTING specifically adjusted to give the desired composition after remelting are listed, with the chemistry and as-cast physicals, in the MasterMet Alloy Bulletin, published by Cannon-Muskegon Corp.

14. FOR SAFE OPERATION of hydraulic lines, use of a fire resistant fluid, particularly around open flames or hot metal is recommended in a bulletin, Form 7380, from Carbide & Carbon Chemicals Co. that fully describes their Ucon Hydrolube.

15. EXTRA HEAVY, all-steel linkage is said to be one of the bonus features of Cast Master die casting machines, described in the new Cast Master catalog.

16. PERMANENT MOLD CASTINGS in aluminum that combine accuracy, high density and low cost are described in a new brochure from Centr-o-Cast & Engineering Co.

17. "CRUCIBLE CHARLIE" is the commentator in a series of leaflets published by the Crucible Manufacturers Association, outlining important facts about crucibles for melting.

18. COMPLETE DATA FILE on stock and special die and mold components has been prepared by the Detroit Mold Engineering Co.

19. CLEANING METALS? New literature published by Enthone, Inc. gives the latest methods.

20. METAL WORKING LUBRICANTS specifically designed for almost every type of job such as die casting, machining, drawing, etc. are described and the proper use of each given in booklets from Fiske Bros. Refining Co.

21. HIGH STABILITY METAL POWDERS that meet every requirement for uniformity, purity, consistency, strength and low oxide content are fully discussed in technical data available from The Glidden Co.

24. CAN IT BE MADE from iron powder? The free literature package from Hoeganaes Sponge Iron Corp. contains many of the answers to what can and what can not be made from iron powder.

26. MECHANICAL CLAMPING is one important feature of die casting machines presented in a catalog of Hydraulic Press Manufacturing Co.

28. CONSTANT OIL TEMPERATURES means uniform high productivity from die casting machines. Bulletin 1.1K5 from Kewanee-Ross Corp. gives the advantages that result from the use of heat exchangers on die casting machine oil lines.

29. COMPLETE DIE CASTING machine catalog, illustrating and giving specifications of a full range of machine sizes, is available from Kux Machine Co.

30. FIRST THE BASIC machine: then as needs grow the die casting machines by Lake Erie Engineering Corp. can grow with them. For the full story of these "expandable" machines the company offers a new bulletin.

31. DIE CASTING MACHINES in a complete range of capacities and types, are the subject of a catalog offered by Lester-Phoenix.

32. MELTING AND HOLDING FURNACES of several types are introduced in three brochures from Lindberg Engineering. Included are electric resistance and fuel-fired melting and holding furnaces, as well as a hydraulic, nose-pour tilting crucible furnace.

33. FOR DESIGN INFORMATION on die castings Litemetal Dicast, Inc. has prepared an informative bulletin that should be in every design engineer's files.

35. CONVEYOR SYSTEMS, custom built from pre-fabricated standard sections are possible with May-Fran Engineering, Inc. units. Complete information is available in the new bulletin just issued.

37. FOR MAXIMUM SAFETY from hydraulic fluid fires, use a fire resistant fluid. Monsanto Chemical Co. has prepared an informative bulletin on fire resistant fluid Pydraul F-9, 150 and 600.

43. THE PLACE OF ZINC die castings in your manufacturing scheme is told in a new brochure issued by The New Jersey Zinc Co. Applications, economies, etc. are discussed.

45. DIE CASTINGS UNLIMITED is the title of an informative brochure from Precision Castings Co., Inc., describing the die castings produced in the company's 7 plants.

46. UNBREAKABLE PLUNGER RINGS for die casting machines made from tempered and treated stainless steel give from 8 to 10 times the average life of other rings according to details and recommendations from Precision Piston Rings, Inc.

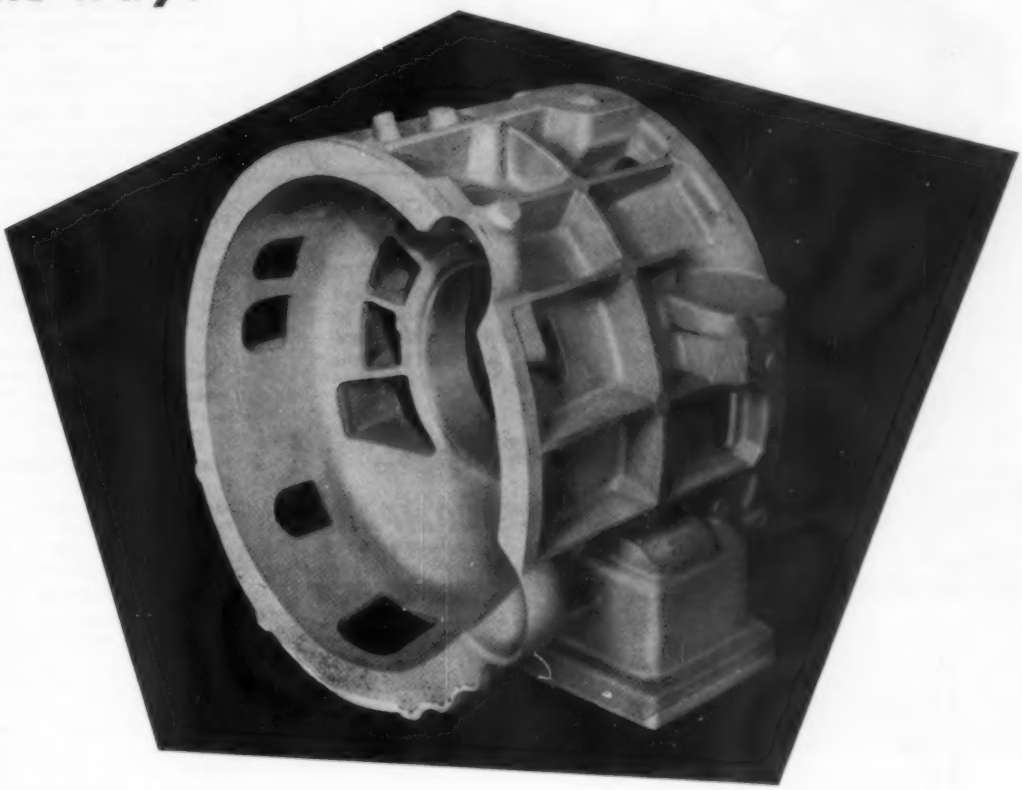
47. CASTING WAXES compounded specifically for the investment casting industry are described and all of the necessary pertinent data given in technical data sheets available from the Petrolite Corp.

48. INCREASED PRODUCTION due to higher cycling speeds and higher injection pressures on the new Reed-Prentice die casting machines are reported in specifications and operating information available.

49. FOR POURING MOLTEN non-ferrous metals, Spincraft, Inc. has a wide range of ladles in stainless and mild steel available. A catalog listing all available sizes and types has been issued.

Continued on Page 18

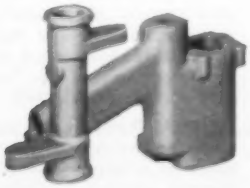
this is the aluminum industrial converter housing they said couldn't be cast this way!



Every company at some time accomplishes a difficult task that brings real satisfaction to everyone. Such is the case with the 65 pound semi-permanent mold casting shown above made for a division of an automotive major. One of our respected competitors said, "It can't be done that way." The casting buyer said, "It's got to be done." We did it, delivered it ahead of schedule, and the costs were right. Everyone was happy about the job.

Centr-O-Cast manufactures a complete range of aluminum castings in the permanent mold, semi-permanent, centrifugal, and centrifuge fields ranging in weights from 2 ounces to 65 pounds. All alloys are used, either regular or heat treated. Operating at the rate of 750,000 pounds of finished castings per month Centr-O-Cast ranks as one of the larger permanent and centrifugal casting foundries in the country.

Next time your drawings call for aluminum we would like to help. A card will bring an illustrated brochure, or, if you prefer, a personal call by our casting consultant.



Small permanent mold aluminum castings which proved that quality need not be expensive.

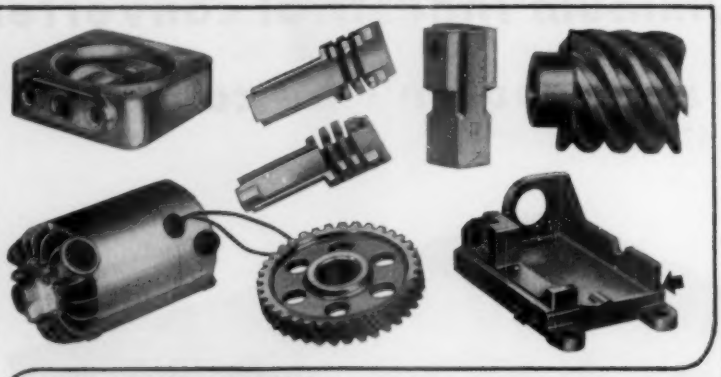
centr-o-cast

CENTR-O-CAST AND ENGINEERING COMPANY

45 St. Jean Avenue, Detroit 14, Michigan

For more information circle No. 16 on the Reader Service Card

For more information circle No. 36 on the Reader Service Card



DIE CAST PARTS *to Your Specifications*

A pioneer in the die casting art, *Milwaukee* has long been a recognized leader in supplying *Die Castings as Specified* to all types of industry for all types of products from small precision instruments to massive heavy duty machinery. That is why you can entrust *Milwaukee* to produce die cast parts to your most exacting specifications — not only in dimensions — but in contour, weight, strength, pressure resistance, wear resistance, finish and other vital characteristics.

We Operate under the Certified Zinc Plan of the American Die Casting Institute, Inc.

MILWAUKEE DIE CASTING COMPANY
4146 N. HOLTON STREET • MILWAUKEE 12, WISCONSIN
Established 1909

Quality Investments for Precision Casting

"Everything for Casting"

"Whip-Mix" INVESTMENTS

FERROUS

- FERROTEX #8 — Single Coat Investment
- FERROTEX #30 — Outer Investment For Ethyl Silicate Precoat

NON-FERROUS

- CHEMITEX #2 — Especially Formulated For Large Castings
- CHEMITEX #10 — Excellent For All Castings
- CRISTOBALITE — JEWELERS — For Fine Castings
- CORVEST — Formulated Especially For Cores

Write today for further information, specifications & prices.

EXCLUSIVE DISTRIBUTORS FOR "WHIP-MIX" CORPORATION.

CENTRIFUGAL CASTING SUPPLY CO.
147 WEST 42nd STREET • NEW YORK 36, N.Y.

For more information circle No. 71 on the Reader Service Card

DATA IN ADS—Continued

50. FULLY AUTOMATIC or semi-automatic powdered metal presses are described and specifications given in bulletin 670 from the F. J. Stokes Machine Co.

53. AMORPHOUS TYPE SILICA with low moisture content and controlled pH and in particle size ranges from 1 to 15 microns is described in a brochure from Tamms Industries, Inc. Samples are available.

57. MORE PARTS PER DOLLAR by powder metallurgy is the subject of a brochure available from Powdered Metal Products Div., Yale & Towne Mfg. Co.

58. STOP CORROSION, either with or without an overcoat of paint. The Iridite process on non-ferrous metals can do the job, according to complete technical information available from Allied Research Products.

59. AIR MOTORS for precise and high speed operations are described in a new illustrated booklet "The Bellows Air Motor," being distributed by The Bellows Co.

60. FOR SURFACE TREATMENT of non-ferrous metals, The Chemical Corp. has a group of Luster-On preparations. Operating data, technical reports and service reports are contained in literature now available.

61. LEAD SCREW TAPPING equipment of the latest design with all electric operation and control and designed for the fastest, most accurate tapping is described in Bulletin A. T. U. from Ettco Tool Co., Inc.

62. HOW TO CONVERT a hand-operated drill press to automatic operation by using an air-operated, hydraulically controlled drill feed is explained in a booklet from General Pacific.

63. BARREL FINISHING with the new Honite methods and media is explained in a complete Facts and Figures Report on the method, ready for distribution by Minnesota Mining & Mfg. Co.

65. SURFACE TREATMENT of metals prior to painting makes the difference between good and bad finishing jobs. The Phosteem bulletin 55-137 describes one of the most advanced methods developed by Neilsen Chemical Co.

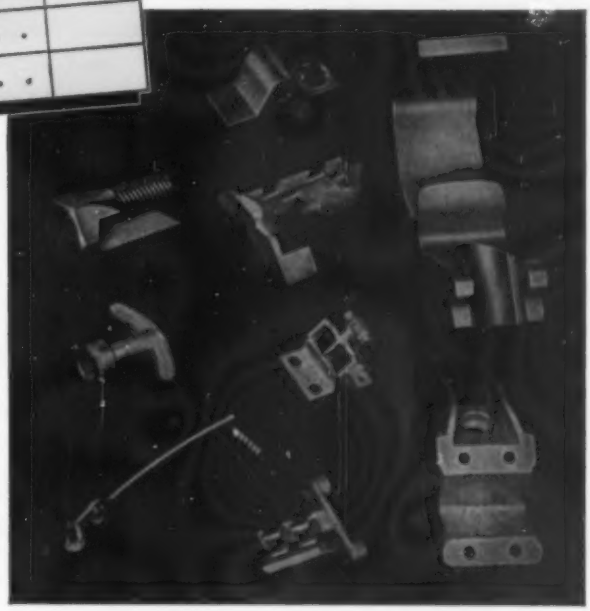
66. HIGH PRODUCTION rate, machine deburring and chamfering with the new Nobured and Nobursink tools, and the best method of using them are reported in literature available from Nobur Mfg. Co.

67. STRIPPERS that work fast and efficiently on any type of painted or lacquered surface are described in literature prepared by Oakite, Inc.

70. DON'T SCRAP porous castings, seal them. Western Sealant Co.'s brochure #17 tells how to salvage porous castings by impregnation.

DOES YOUR COMPONENT PART REQUIRE:	
1. COST REDUCTION	
2. HI-STRENGTH	
3. CORROSION RESISTANCE	
4. MANY MACHINING OPERATIONS	
5. THAT IT BE MADE FROM BRASS, BRONZE, OR ALUMINUM	
6. IMPROVED APPEARANCE FOR SALES APPEAL	
7. INTERLOCKING PARTS	
8. HIGH-STRENGTH BEARING QUALITIES	

If you can check one item on this list, send us your blueprints for estimating . . .



We'll prove to you

ALCALOY

can save you money on

COMPONENT PARTS

We have a new permanent mold casting process and an exclusive bronze alloy that team up to give you a big cost reduction advantage in your products. Keep these facts in mind when you're designing and planning production.

Alcaloy castings are uniformly close-grained, clean, sound and free from cavities and surface flaws. All dimensional tolerances are held within specifications. This means low machining costs, less scrap, less shop equipment. First costs of castings often are lower than other types.

Our special bronze alloy is non-sparking, non-magnetic, corrosion-resistant and light gold bronze in color. It remains free from tarnish and pitting. Some grades have the strength of steel and hardness of C 35-40. This alloy is valuable in safety tools, machine parts, chains, fittings, utensils and many other products.

We are increasing our facilities to insure prompt delivery on component parts. Send us blueprints or return the coupon below for the complete, money-saving Alcaloy story.

ALCALOY, INC.
P. O. BOX 503 TRENTON, NEW JERSEY
ASSOCIATED WITH DICKEY INDUSTRIES

*** ACCURATE INSPECTION INSURES UNIFORM QUALITY**

Every phase of Alcaloy production is supervised by experienced metallurgists. We are licensed by U. S. Atomic Energy Commission to use Cobalt 60 in testing castings for internal flaws. You can depend on Alcaloy quality.

Send information on Alcaloy Casting Process ☐
Send new Alcaloy catalog ☐

Name _____ Title _____
Firm _____
Address _____
City _____ Zone _____ State _____

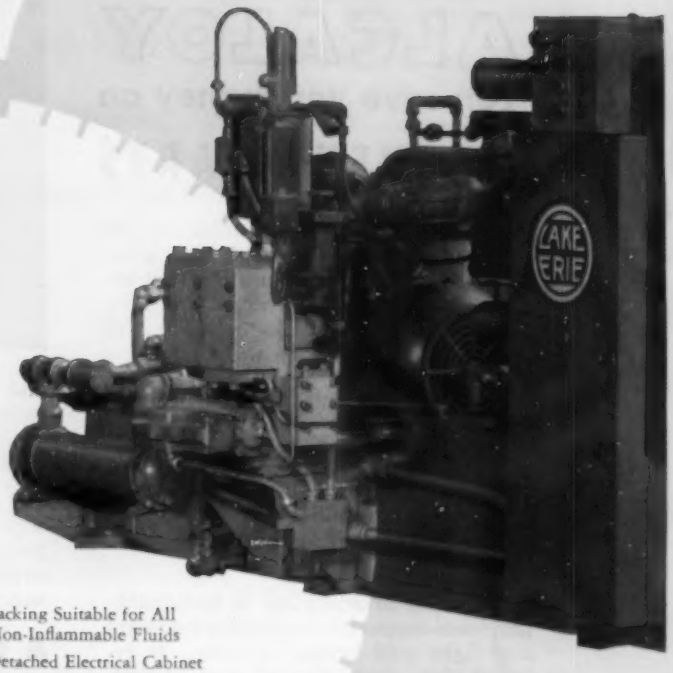
For more information circle No. 5 on the Reader Service Card

NOW... *A Die Casting Machine that*
EXPANDS WITH YOUR NEEDS

by LAKE ERIE ENGINEERING CORP. BUFFALO, N.Y. U.S.A.

LAKE ERIE®

- Available in capacities of 250, 450, 650 and 850 tons.
- Hot chamber or cold chamber models as desired.
- All models are equipped with an improved version of the highly successful Wedge Cam Toggle. The incorporation of knuckled joints eliminates the use of pressure pins when under locking pressure.



TODAY...

- Buy the unique Lake Erie Series D "expandable" Die Casting Machine as a basic tool with only the essentials required for your present production. This saves money . . . yet gives you rugged characteristics and top quality never before obtainable in a simplified machine. Incorporated in all models of the new Series D are:

- Larger Die Area
- Low-Stressed Tie Bars
- Faster, Smoother, Die Closing
- Lower Frame — Engineered Working Height
- Manifold Valving
- New Knuckled, Wedge Cam Toggle
- Simplified Electrical & Hydraulic Systems
- Easier Conversion from Aluminum to Zinc
- Packing Suitable for All Non-Inflammable Fluids
- Detached Electrical Cabinet
- Reserve Pumping Capacity
- Mechanical Ejection
- Automatic Lubrication

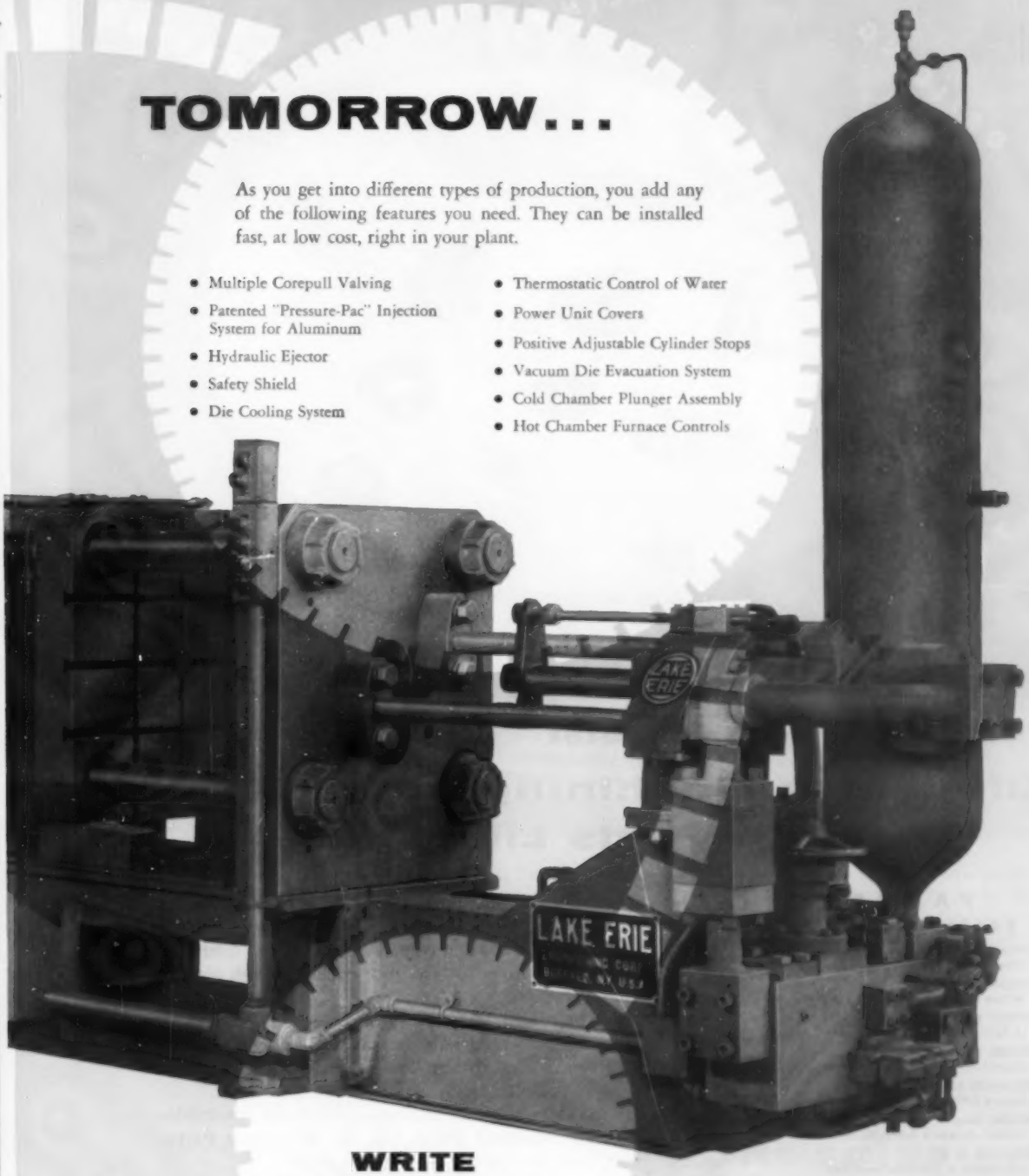
OPTIONAL EQUIPMENT

- Safety Hook
- Screw for Die Height Adjustment

TOMORROW...

As you get into different types of production, you add any of the following features you need. They can be installed fast, at low cost, right in your plant.

- Multiple Corepull Valving
- Patented "Pressure-Pac" Injection System for Aluminum
- Hydraulic Ejector
- Safety Shield
- Die Cooling System
- Thermostatic Control of Water
- Power Unit Covers
- Positive Adjustable Cylinder Stops
- Vacuum Die Evacuation System
- Cold Chamber Plunger Assembly
- Hot Chamber Furnace Controls



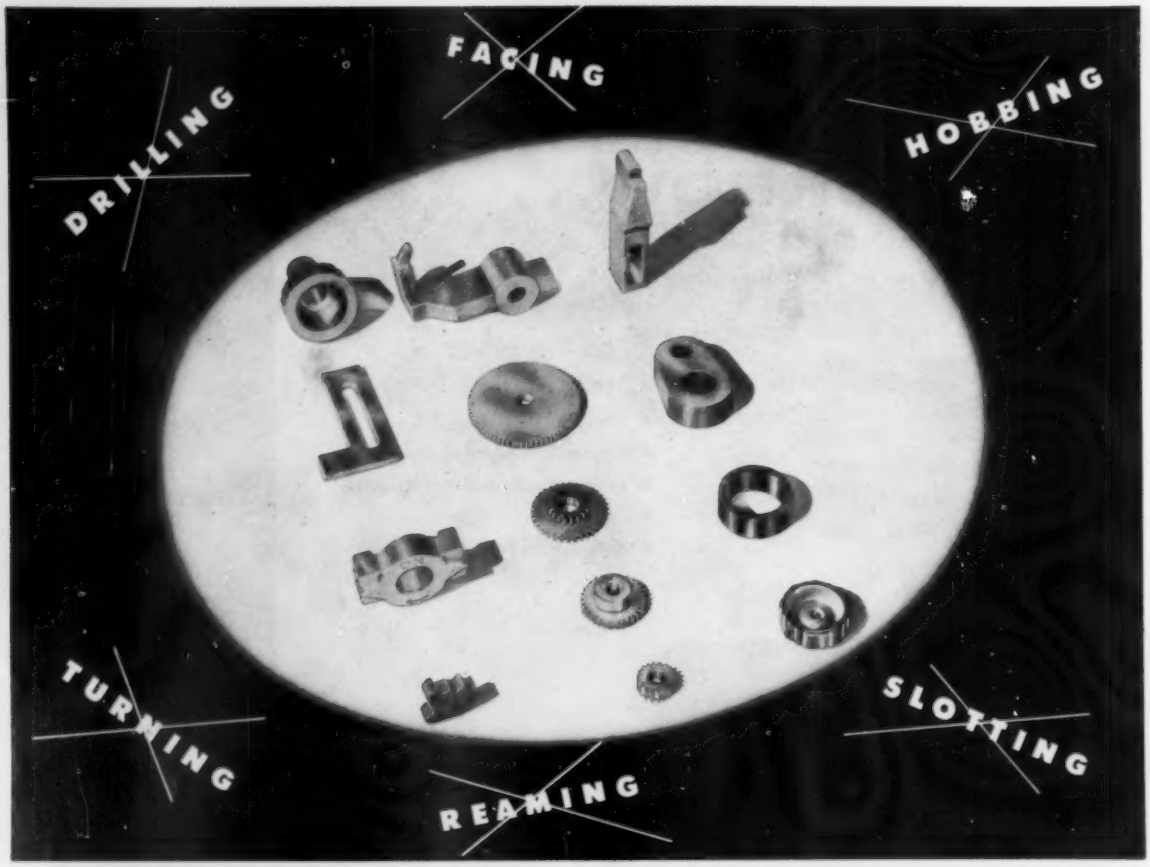
WRITE FOR DETAILS

Send today for Circular 255 describing this new and unusual "expandable" Die Casting Machine.

LAKE ERIE ENGINEERING CORPORATION

520 Woodward Avenue, Buffalo 17, N. Y.

For more information circle No. 30 on the Reader Service Card



PARKER Powdered Metal

Eliminates Machining Costs On Parts Like These...

PARKER
SALES ENGINEERS

CHICAGO 49, Ill.
Ollie J. Berger Company • 2059 East 72 Street

CINCINNATI, Ohio
William H. Broxterman • 2174 Buck Street

DETROIT 35, Mich.
Hodgson-Geisler Co. • 18917 James Cousens

GIRARD, Penna.
Daniel F. Marsh • 35 Chestnut Street

KIRKWOOD 22, Mo.
Edward F. Higgins, Jr. • 102 West Adams Street

WILTON, Conn.
Girard L. Palmer • Belden Hill Road

SYRACUSE, N. Y.
J. C. Palmer • 712 State Tower Bldg.

BELLEFONTE, Penna.
Warren G. Olson • 420 East Linn Street

One sure way to cut costs on small metal parts is to eliminate machining operations. Parker Powdered Metal produces the above parts in **one press operation** . . . complete . . . to close tolerances . . . at cost savings of from 70% to 90% compared with conventional machining methods.

And Parker Powdered Metal Parts offer other important advantages. Tensile strength, ductility, density, impact resistance and other physicals are closely controlled to meet exacting specifications. Tooling-up is done quickly and at relatively low cost.

It will pay you to check on the economies and design possibilities offered by Parker Powdered Metal. Just call the nearest Parker sales engineer listed here or write the factory direct.

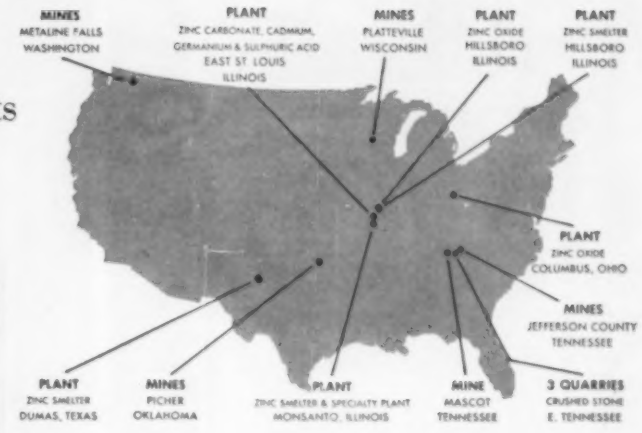
Parker White Metal Company • 2153 McKinley Ave., Erie, Pa.

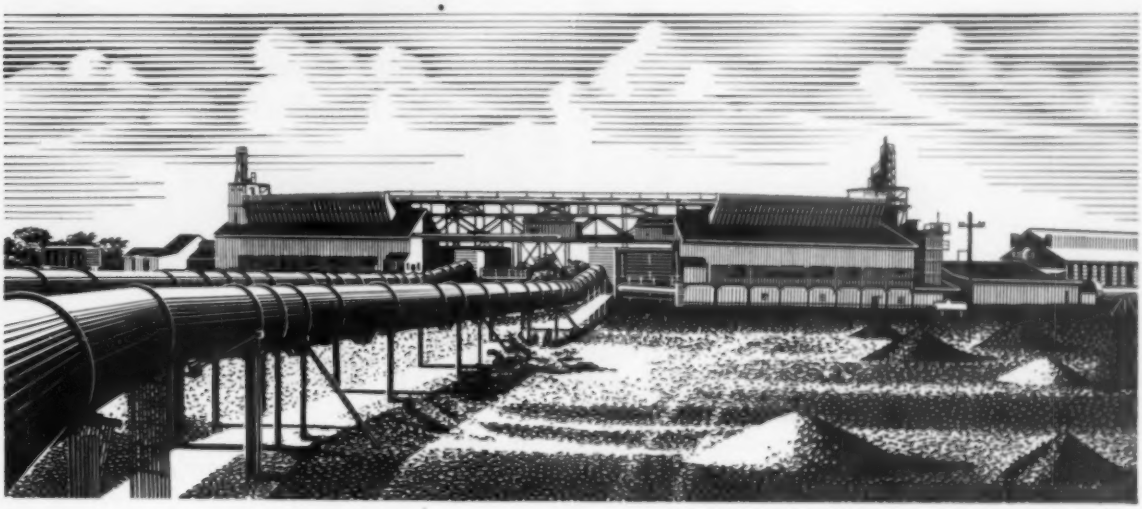
PARKER

POWDERED METAL PARTS
ALUMINUM and ZINC
die castings

For more information circle No. 44 on the Reader Service Card

American Zinc and its products *from* A *to* Z





DUAL OPERATION AT HILLSBORO, ILLINOIS

(1) The Oxide Division supplies American process lead-free and leaded zinc oxide, as well as French process zinc oxide. (2) In the Metal Division, Prime Western, Select, Brass Special, Intermediate and High Grade slab zinc are produced. For complete picture of American Zinc operations, see map above.

PRODUCERS OF

ALL GRADES OF SLAB ZINC
ZINC ANODES (Plating & Galvanic)
METALLIC CADMIUM
SULPHURIC ACID
LEAD-FREE and LEADED ZINC OXIDES
ZINC CARBONATE
GERMANIUM DIOXIDE
AGRICULTURAL LIMESTONE
CRUSHED STONE

Distributors for

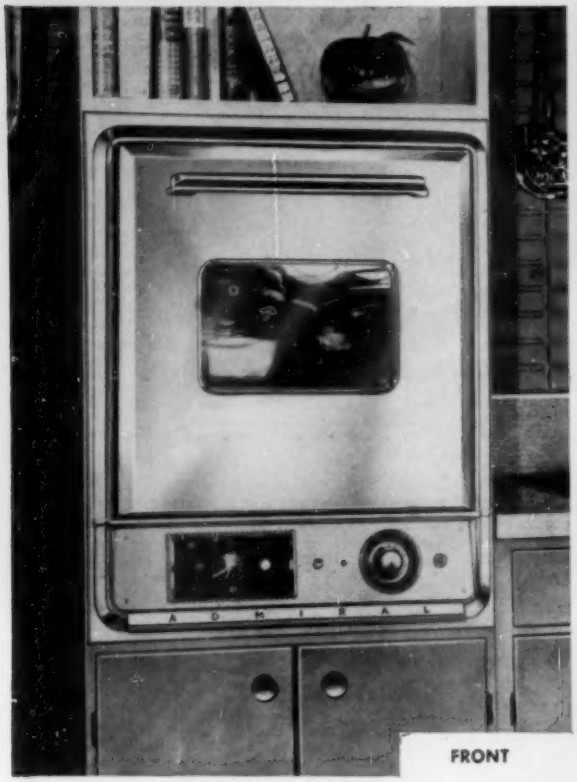
American Zinc sales Company

AMERICAN ZINC, LEAD & SMELTING COMPANY

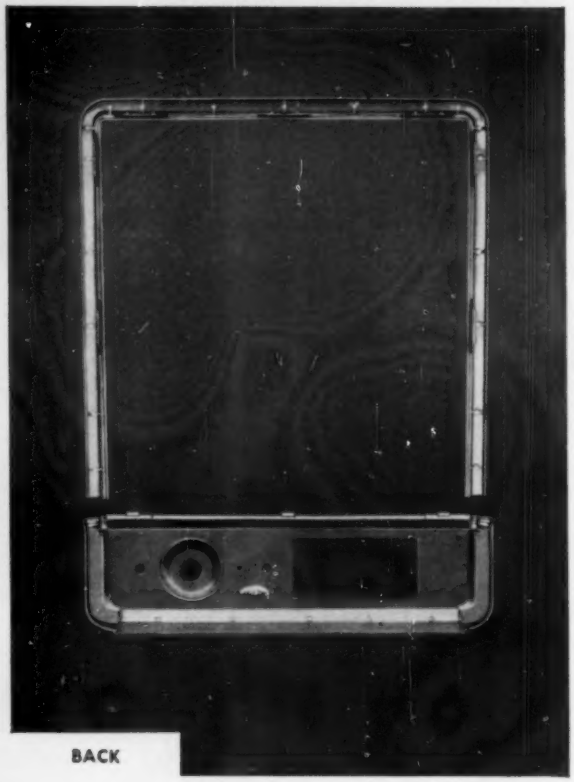
Columbus, Ohio • Chicago • St. Louis • New York • Detroit • Pittsburgh

For more information circle No. 7 on the Reader Service Card

WHY ZINC RATES FIRST IN DIE CASTING • NUMBER 6 OF A SERIES



FRONT



BACK

rigidity – as needed by *Admiral*

Built-in electric ranges and wall ovens are the latest products of the fertile minds of appliance designers. And the most efficient methods and materials are employed for each component of the new space-saving cooking units. The illustrated custom wall oven by Admiral, with its ZINC die cast inverted-U door frame and control panel, is an excellent case in point.

Obviously the frame and panel (back views above) could have been stamped from sheet metal, but not with the qualities and economies of these ZINC die castings. Stampings not only would lack the desired rigidity, but would not possess the following additional advantages obtained with die castings:

1. No scrap loss
2. Integral mounting bosses for easy assembly
3. Dimensional accuracy for perfect fit of mating parts
4. Bold raised lettering on the control panel
5. Smooth as-cast surfaces which—being ZINC—take, and hold, beautiful chromium plating applied by commercial methods

Watch for other examples of ZINC die casting economies in our future advertisements. Send for our brochure and contact any commercial die caster for the answers to your particular production problems.

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The Research was done, the Alloys were developed, and most Die Castings are based on

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Here is maximum safety from hydraulic fires!

Pydraul F-9 hydraulic fluid was poured onto molten metal.

But even at 1200° F. Pydraul didn't burn.

That's because the Pydrauls are fire-resistant *chemicals.* They have all the lubricity of premium petroleum oil without the fire hazard, plus being noncorrosive, chemically stable, nontoxic, and reclaimable.

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Can you honestly afford *not* to use it?

Use Pydraul F-9, Pydraul 150, or Pydraul 600 in your hydraulic equipment. For FREE copy of informative "Pydraul F-9" booklet, or data on Pydraul 150 and Pydraul 600, write: Organic Chemicals Division, MONSANTO CHEMICAL COMPANY, Box 478-H-8, St. Louis 1, Mo.

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On May 31, 1955, Pydraul F-9 became the first fire-resistant hydraulic fluid listed by Underwriters' Laboratories. From the Laboratories' Service Card: "The fire hazard of (Pydraul) is rated 2 to 3 in accordance with Underwriters' Laboratories, Inc.'s Standard of Classification in which Ether rates 100, Gasoline rates 90-100, Alcohol(ethyl) rates 60-70, Kerosene (100°F. flash) rates 30-40 and Paraffin oil rates 10-20." See Underwriters' Laboratories, Inc.'s guide no. 540 18. File MH6049.

Pydraul: Reg. U. S. Pat. Off.

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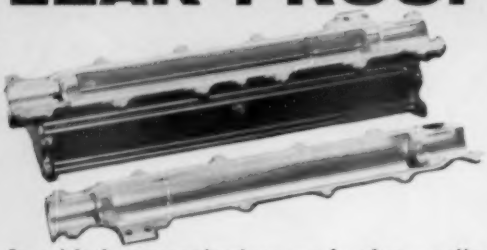
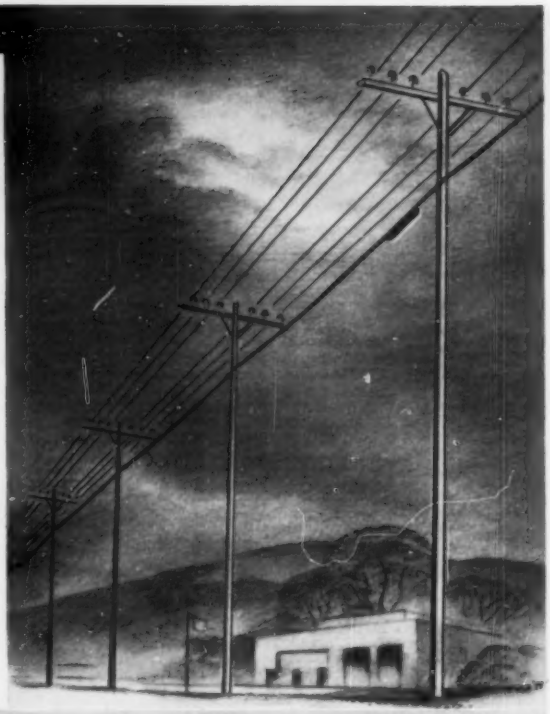
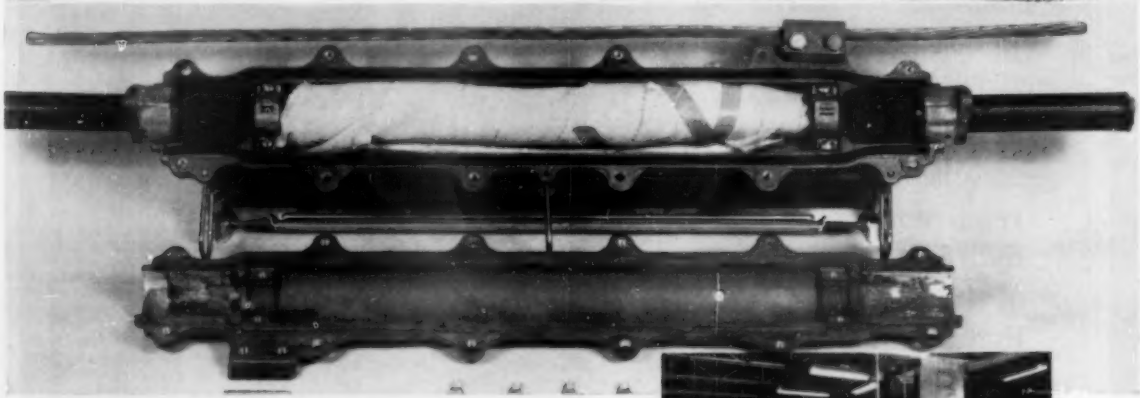
these die castings had to be

LEAK-PROOF



In critical communications work, after a splice has been made on a telephone aerial distribution cable, the splice must be protected against moisture. To accomplish this, Western Electric Company is producing a die cast aluminum splice case, basically cylindrical, the two halves of which are bolted together with suitable gasketing material. The housing thus forms a weather-tight seal capable of withstanding internal gas pressure of 10 P. S. I.





These parts are run at New England Die Casting Company. Many other parts, meeting the same exacting requirements of the most critical industrial applications, are run in the all-Lester-shop.

Mr. Charles W. Ohse, President of New England Die Casting, knows that he can offer his customers the best in die castings because he has the best in die casting machines—Lesters.

If you want additional information about Lester machines just drop us a line. And ask to receive the Lester-Phoenix house organ, "The Lester Press."

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For more information circle No. 31 on the Reader Service Card

A review of recent U.S. PATENTS

MOLDING PRESS having both upper and lower movable plungers and featuring a variable cycle control mechanism. Depth of fill, pressing stops and all other movements in the press cycle are controlled by a servo-mechanism. All individual phases of the filling, pressing and ejection cycle can be independantly varied.

(Patent No. 2,712,168 — Frederick J. Kenline — assigned to Lake Erie Engineering Corp. — issued July 5, 1955).

BRIGHT NICKEL PLATING process in which the nickel is deposited from an acidic aqueous solution of a nickel salt. The solution contains from 0.2 to 3.0 grams per liter of an acetylenic compound from the group consisting of 2-butyne- 1, 4-diol, 4-methoxy-2-butyn-1-ol, 3-hexyne-2, 5-diol, 4-diethylamino-2-butyn-1-ol, 4- (N-morpholinyl)-2-butyn-1-ol, 3-pentyn-1-ol, 2,4-hexadiyne-1,6-diol, and 1-diethylamino-2-propyne.

(Patent No. 2,712,522—Otto Kardos, Thomas J. Menzel, and James L. Sweet — assigned to Hanson-Van Winkle-Munning Co. — issued July 5, 1955).

A METHOD for reducing the pyrophoricity of uranium hydride powder. The uranium hydride powder is brought in contact with the vapor of an aliphatic amine in which the ratio of the number of carbon atoms to the number of nitrogen atoms is not greater than six.

(Patent No. 2,712,979 — Thomas R. P. Gibbs, Jr. and William H. Pasfield — assigned to the U.S.A. as represented by the United States Atomic Energy Commission — issued July 12, 1955).

IMPROVEMENT IN THE PROCESS for the production and purification of titanium. In the process, titanium-bearing material is placed in contact with and reacted with a vapor of an alkaline metal fluoride in a chamber maintained at a temperature that will keep the fluorides in the vapor state. The reacted fluorides are then brought into another chamber where condensation occurs. The improvement comprises providing in the cooler chamber titanous fluoride vapor in an amount sufficient to react with all of the alkali metal. Under these conditions the

Continued on page 32

TWO machined parts $1.00
TEN Powdermet* PARTS .... $1.00 (10¢ each)

Don't cut parts—*Cut Costs* with YALE Powdered Metal Parts

Yes, powder metallurgy has an important price story—because when you save the extensive and costly operations involved in machining, it shows up in *more parts* and lower production costs!

But at Yale & Towne, there's another story of *equal* importance ...*complete* engineering service, the kind you can trust—from consultation through production and delivery of parts that are *really* right!

Engineering service has given Yale & Towne its position of leadership in powder metallurgy. We are careful to *recommend only applications where Powdermet* parts will perform successfully.* Then, in design and production of these parts, Yale & Towne offers the experience, know-how, modern facilities and creative ingenuity that *assure* best results.

As a part of this complete engineering service, Yale & Towne maintains a continuous special training program for well-qualified engineers. These men become Powdermet* consultants—available to discuss the advantages and limitations of Powdermet* parts *right in your own plant.* They will show you how Powdermet* may cut your production costs and improve your product. And there is *no obligation* for this engineering counsel.

TAKE ADVANTAGE of Yale & Towne's skilled engineering assistance on your powdered metal problems.

Arrange for a visit by a Yale & Towne consultant —today!

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Lindberg-Fisher manufactures all types of Aluminum Melting and Holding Furnaces for permanent mold application— Gas-Oil- Electric resistance.

Lindberg-Fisher engineers can intelligently recommend the type of furnace to best suit your needs and conditions.

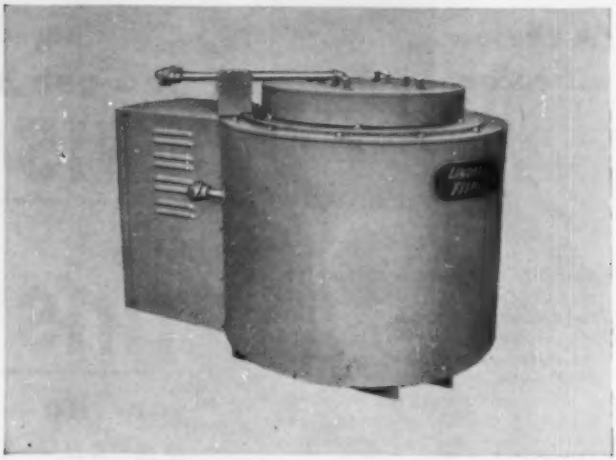
Melting specialists for 25 years

Sales and service offices in principal cities

LINDBERG FISHER

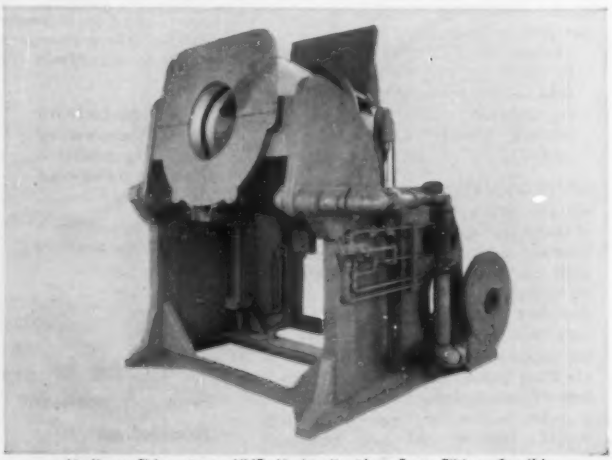
MELTING FURNACES

A Division of Lindberg Engineering Company, 2463 West Hubbard Street, Chicago 12, Illinois



Lindberg-Fisher Electric Resistance Aluminum Melting and Holding Furnace equipped with heavy duty resistance elements which give uniform distribution of heat, insuring long element and pot life. Capacities up to 1000 lbs. Described in Bulletin 320.

Lindberg-Fisher type ADC Aluminum Melting and Holding Furnace. Capacities up to 1000 lbs. of aluminum. Oil or gas fired. Described in Bulletin 301.



Lindberg-Fisher type HNP Hydraulic Nose-Pour Tilting Crucible Furnace. Pouring lip is located in the axis of tilting providing a constant pouring arc regardless of degree of furnace tilt. Capacities up to 1000 lbs. of aluminum. Oil or gas fired. Described in Bulletin 57-A.

For more information circle No. 32 on the Reader Service Card

51
USCO
USCO K-Z
USCO K-Z Aluminum Die-Casting Alloy is a high zinc variation of the popular USCO K. In other words, USCO K-Z is an AXS-679 Revision 3 alloy with zinc up to 2% maximum. The physical properties of K alloy are retained in the K-Z alloy, at a price saving to you.
USCO K-Z, like all other USCO Aluminum Alloys, is production and quantometric controlled from raw materials to finished ingot under the most modern methods of alloying and refining—giving you the properties you desire in your castings.
As with all USCO Alloys, if you desire, K-Z can be tailor-made to fit your specific needs.
Let our metallurgical engineers, who have a practical working knowledge of die-casting, aid you in selecting the correct alloy and assist you with your melting and casting problems.
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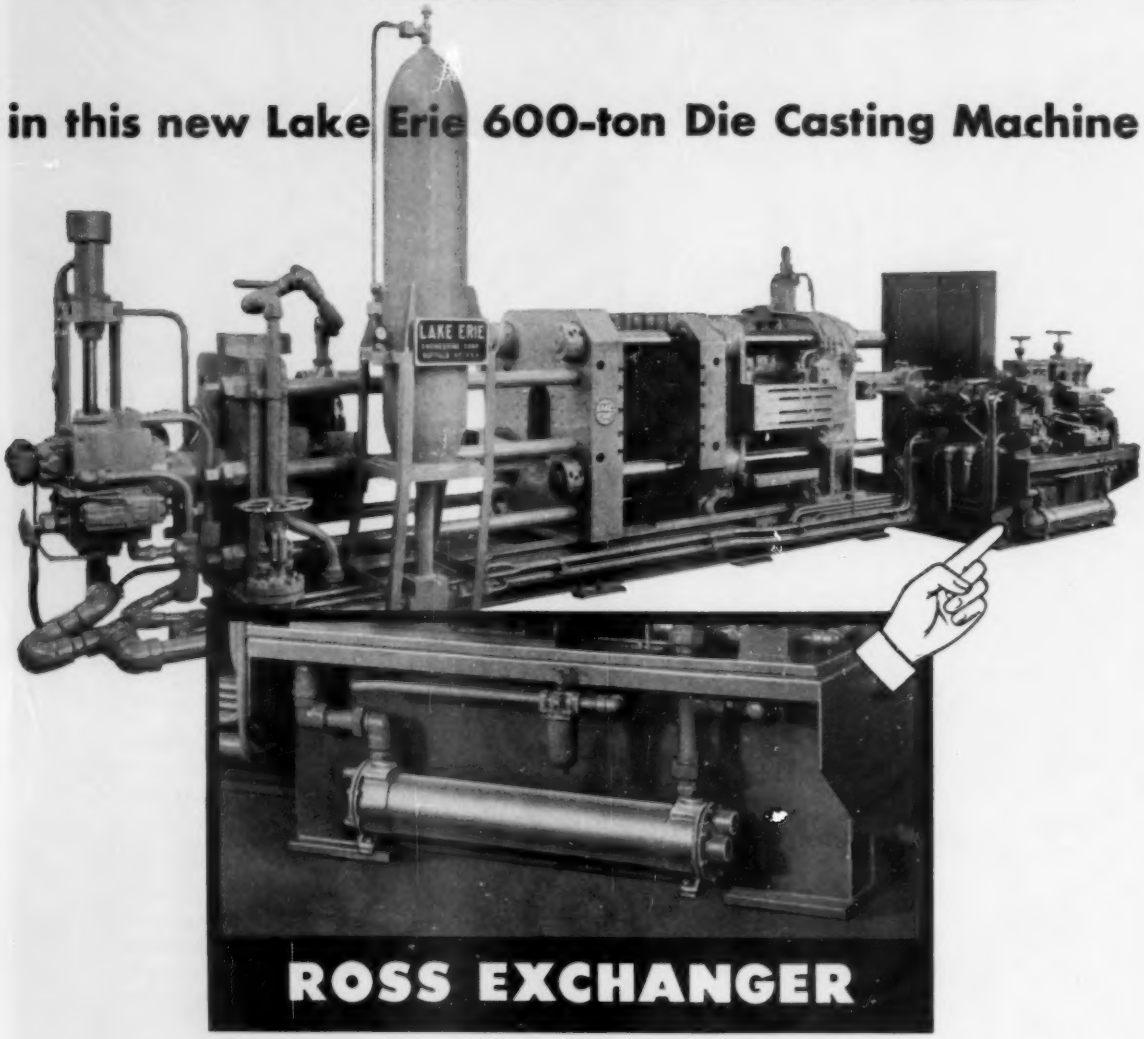
For more information circle No. 55 on the Reader Service Card

maintains constant oil temperature

in this new Lake Erie 600-ton Die Casting Machine



Operating at 450 free cycles per hour and capable of producing aluminum castings weighing up to 12 lbs., this new Lake Erie Model A-60 Die Casting Machine is rated at a locking pressure of 600 tons.

To insure combined 2-pump capacity of 20.6 gpm at 1000 psi, by providing safe, dependable oil cooling, a built-in Ross Type BCF Exchanger has been provided. *Hydraulic power losses, caused by excessive temperature, are thus prevented!*

"Ross oil coolers are selected on the basis of performance, economy and availability," states Lake Erie Engineering Corp.

Rugged, dependable and top-rated for thermal efficiency, all copper and copper alloy Ross Type BCF Exchangers are preferred by manufacturers of numerous types of hydraulic machinery. Pre-engineered and fully standardized, they are stocked in a wide range of sizes to meet your needs . . . *promptly*.

For detailed information, request Bulletin 1.1K5.

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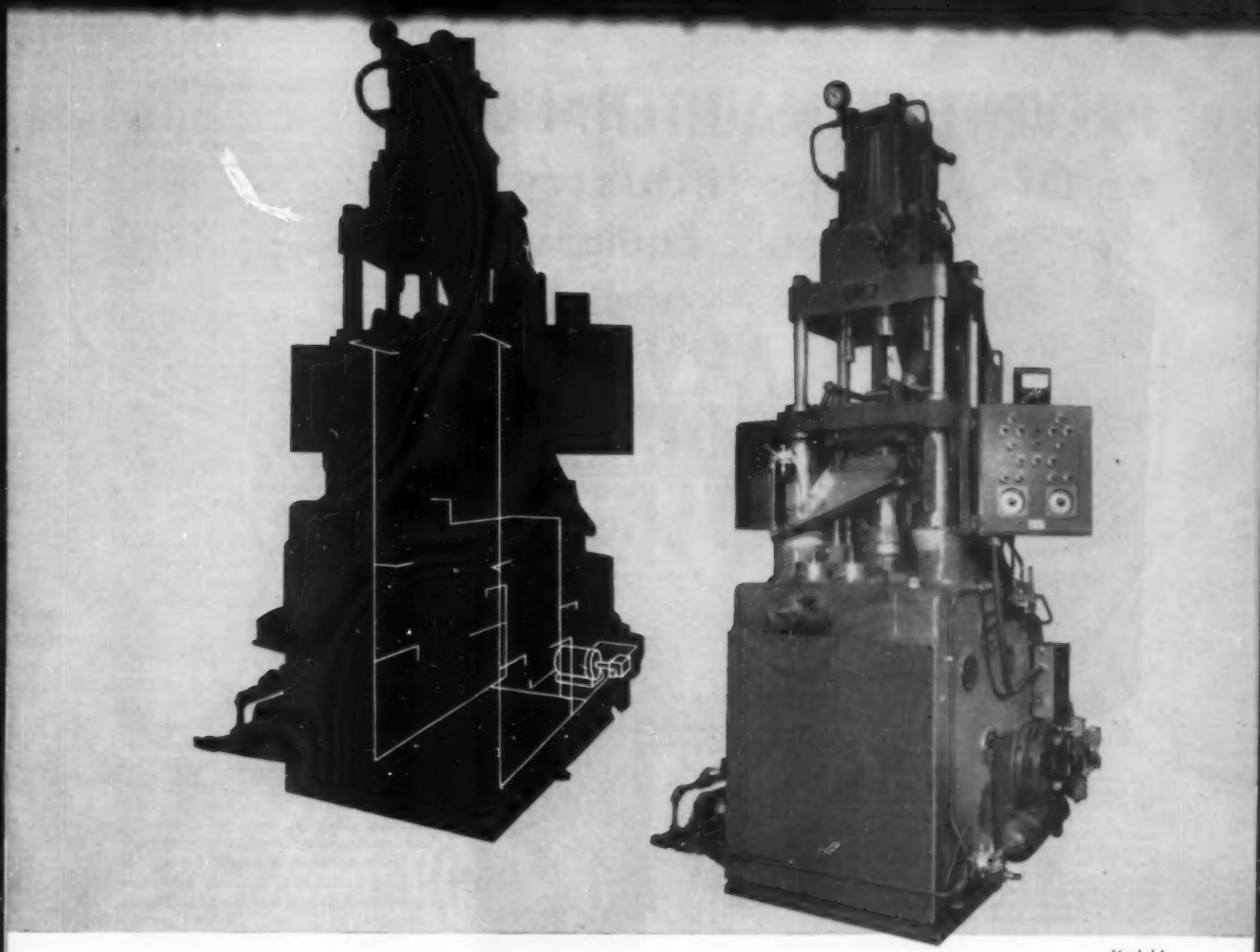

Model L

AUTOMATIC LUBRICATION protects new Baldwin powdered metal presses

Baldwin Model "L" and "C" powdered metal presses are just what you need for highest-quality and lowest-cost production. That's true because these new 50 and 100 ton presses are the first designed specifically for compacting metal powders.

A big reason why you'll get such low cost production is their automatic lubrication. In both presses a gear type oil pump, independently driven by a fractional horsepower motor, automatically lubricates all moving parts continuously. It forces filtered oil through a drilled crankshaft to the crank and connecting rod bearings. It pressure lubricates all other bearings subject to load.

Baldwin Model "L" and "C" presses are designed so that all moving parts are completely enclosed and sealed. Abrasive powder and dirt can't get into the bearings. These presses automatically fail to operate unless there is oil pressure in the lubricating system. An easily serviced oil filter provides further protection.

No other powdered metal presses have been designed just to meet your end product's needs. That's why Baldwin's new presses are your best buy. Only they can give you such uniform compacts and so little press maintenance because they both have automatic lubrication, hydraulic heads, shuttle type feeders, sealed mechanism, simple fill adjustments and variable cycling.

For more details about "L" and "C" please write to our Dept. 3856, Baldwin-Lima-Hamilton Corporation, Philadelphia 42, Pa.

BALDWIN BLH LIMA-HAMILTON

EDDYSTONE DIVISION

BALDWIN-LIMA-HAMILTON

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simplified with
MARVEL SYNCLINAL FILTERS

SUMP TYPE (cutaway)

Change excessive and costly "DOWN-TIME" to Profitable "OPERATING TIME"

LINE TYPE (cutaway)

Any workman can easily disassemble, thoroughly clean and reassemble MARVEL Synclinal FILTERS, on the spot, in a matter of minutes. RESULT:—The equivalent of a brand new filter, ready for longer periods of dependable service and protection.

MARVEL Synclinal FILTERS are "permanent type" filters because there are no throw-away parts to buy or replace, no moving parts to wear out or break down. Your FIRST COST is your ONLY COST.

Marvel's BALANCED Synclinal design offers 2½ times more ACTIVE filtering area with sufficient storage capacity for filtered-out damaging particles; thus, longer periods of productive operation are attained at minimum filter maintenance "down-time."

You can further simplify your preventive maintenance program by standardizing with MARVEL Synclinal FILTERS, by specifying them on all new equipment and installing them on existing equipment.

FOR EFFICIENT FILTRATION of Hydraulic Oils, Fire-resistant fluids, Coolants, Lubricants, Water—
and
FOR DEPENDABLE PROTECTION on all Hydraulic and other Low Pressure Circulating Systems—
investigate MARVEL SYNCLINAL FILTERS

OVER 600 Original Equipment Manufacturers install MARVEL SYNCLINAL FILTERS as Standard Equipment!

A SIZE FOR EVERY NEED

Available for sump or line installation in capacities from 5 to 100 G.P.M. Greater capacities may be attained by multiple installation (as described in catalog). Choice of monel mesh sizes range from coarse 30 to fine 200.

Immediate Delivery
As in the past, Marvel continues to offer IMMEDIATE DELIVERY!

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Without obligation, please send me complete data on Marvel Synclinal Filters, as indicated:—
- ☐ Catalog No. 100—For Hydraulic Oils, Coolants and Lubricants
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- ☐ Data on filters for Fire-resistant hydraulic fluids.

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Title .....
Company .....
Address .....
City .....
State .....

PMM-12

PATENTS—cont. from pg. 27

first reaction is reversed and metallic titanium is deposited and a mixed alkali titanous fluoride formed.

(Patent No. 2,718,464 — Production and Purification of Titanium — Phillipp Gross and David Leon Levi — assigned to Almin Patents Ltd., London, England — issued Sept. 20, 1955).

PRODUCTION OF IRON CARBONYL by melting iron containing minor amounts of sulfur and casting this melt in plates not more than about 4 cm. thick. The plates are cooled rapidly to room temperature by spraying them with water and are then broken into small particles. These particles are treated with carbon monoxide to form iron carbonyl.

(Patent No. 2,719,077 — Process for the Production of Iron Carbonyl — Leo Schlect and Helmut Schlect — assigned to Badische Anilin- & Soda-Fabrik — issued September 27, 1955).

GOLD ALLOY PLATING BATH for the electrodeposition of a gold alloy that is acid resistant and tarnish proof. The bath composition contains, per gallon of water, between 0.5 and 1.5 oz. of gold cyanide, between 0.166 and 0.5 oz. of palladium chloride and the metals to be co-deposited with the gold-palladium between 0.5 and 1.5 oz. of copper and nickel cyanide each and between 0.05 and 0.16 oz. of cadmium cyanide.

(Patent No. 2,719,821 — Gold Alloy Plating Bath — Charles R. Campana — issued October 4, 1955).

A MOLTEN METAL DISTRIBUTING APPARATUS that operates under constant pressure and head. The system is composed of a melting pot for containing a large supply of molten metal, a pump within the pot and a heated and insulated supply line. The supply line extends vertically from the melting pot and is connected to a distributor feeder. The feeder is connected with a return line so that molten metal can be circulated continuously in a closed circuit. Feed lines are connected with the horizontal supply line and lead to the molds in which casting is to be done. Each feed line is supplied with a valve to control the flow of metal to the mold.

(Patent No. 2,703,313 — Apparatus for Distributing Molten Metal to Molding Machines.— Marshall D. McShurley, Donald G. Mahoney, assigned to General Motors Corp.,—Issued May 3, 1955).

...in the use of ZINC DIE CASTINGS

A prime factor in the rapidly growing use of die castings has been the recognition of the process for what it has proved itself to be: The shortest distance between raw material and finished part. The automotive industry has been especially alert in taking advantage of this high speed production tool. 1955 models use eight times as much zinc die casting in front-end assemblies as the '54 models did.

Since this industry has been the top user of zinc die castings right along — taking more than half the total last year — the impressive swing to more zinc is significant. It definitely establishes the fact that zinc die castings are less costly to produce than those based on any other metal. Because of its low melting point, zinc can readily be cast in the most highly automatic machines. The more automatic and the more rapid the casting cycle, the greater the savings on costs. The smooth, as cast surface of zinc alloy castings is practically ready for plating. This gives zinc an advantage over all other die casting alloys for use as decorative objects and trim. In addition to all of the eye-catching chromium plated zinc die castings, the functional out-of-sight carburetor, fuel pump and windshield wiper housings continue to be zinc die cast at lowest cost.

The utilization of zinc die castings is also making rapid advances for important components in home appliances, hand tools, instruments, electrical equipment, business machines and innumerable other products which, were it not for zinc die castings, would be neither as attractive in appearance, as rugged, nor as low in cost.

BUNKER HILL 99.99+% ZINC

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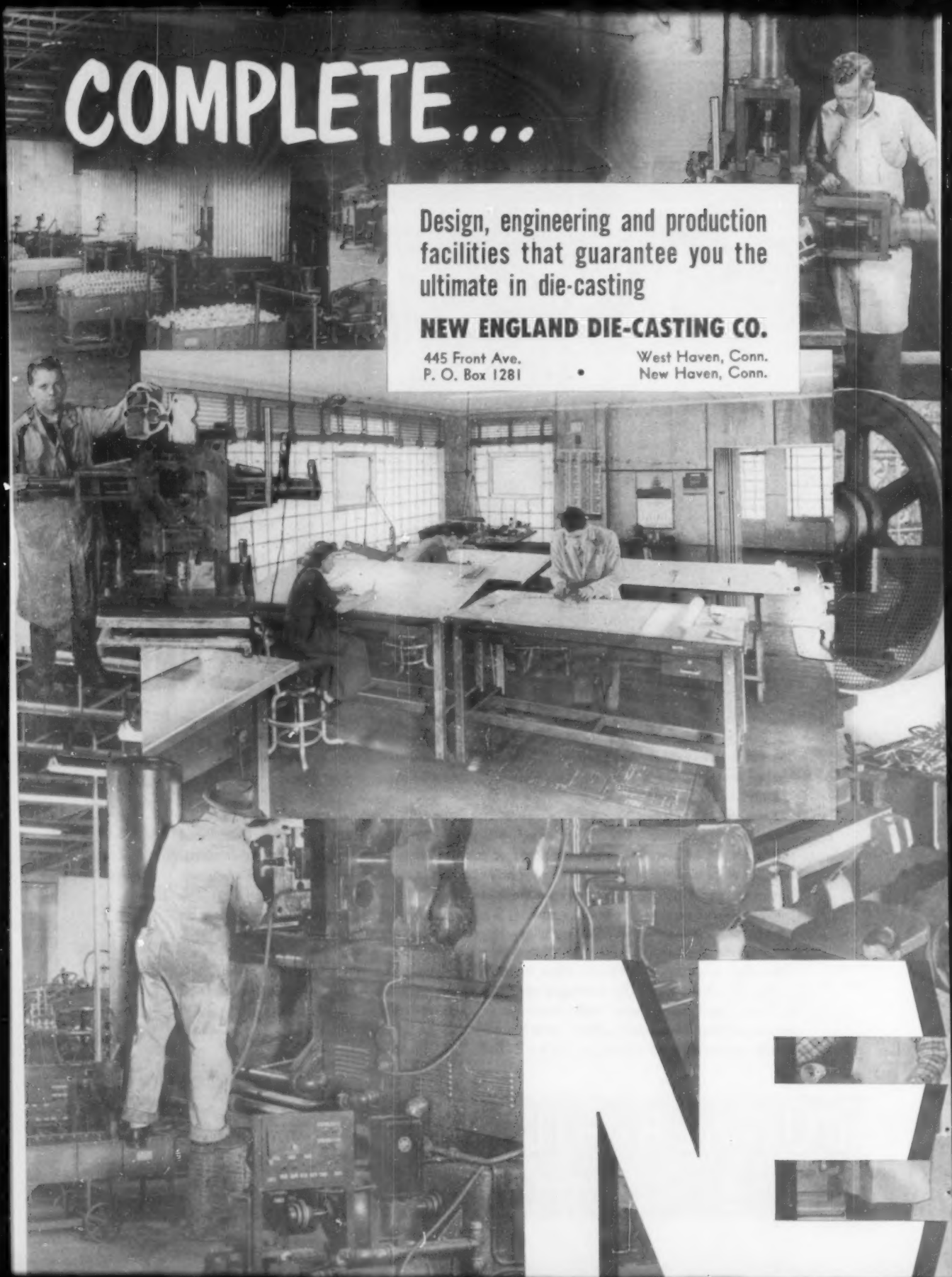
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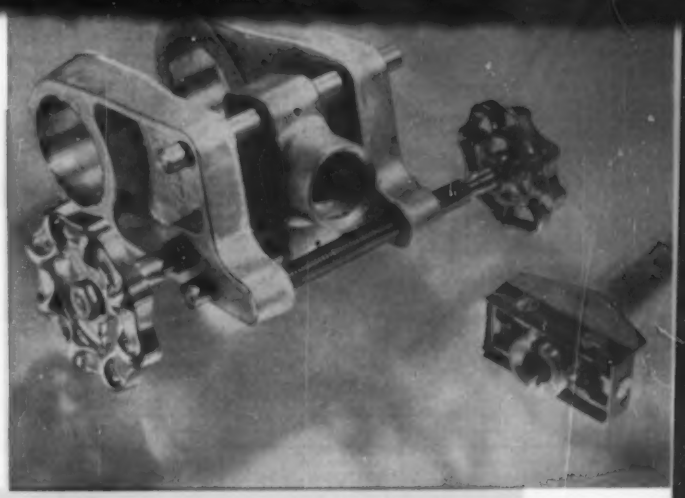


Aluminum die castings give the combination of accuracy and strength needed to make these carpenters' tools.

Perfectly Perpendicular

THERE is little doubt that the development of the tubular lock for doors was brought about by the need to lower labor costs in the construction industry. Where formerly it was possible to employ a highly skilled carpenter to mortise a door to take the lock, as labor prices spiralled something had to be done to eliminate, as far as possible, on-the-job hand work. The tubular lock developed to help lower labor costs requires only two holes bored into the door, one from the edge and one from the face. The work is easily and quickly done, *but the holes must be very precisely positioned with their center lines exactly at right angles to each other.* Unfortunately, many locks are installed without this required exactness.

To guard against misalignment of the holes during boring, the Dexter Lock Co. has developed a simple boring jig which, when clamped onto the door at the correct height, acts as a bit guide so that holes are automatically drilled in the proper position and in the proper relationship to each other.

The requirements of such a boring jig are simple, but they must be met. The jig must, first of all, be accurate. Next, it must be rugged so that it will not be broken or knocked out of alignment under normal usage. It should be as light weight as possible and, finally, it should be inexpensive so that all carpenters can afford to own and use it. All of these requirements have been met in the Dexter Jig through the wide use of aluminum die castings.

An assembled jig is shown above, as well as the die cast aluminum components. The two plates which bear against the interior and exterior faces of the door are cast with a heavy section where bending stresses are likely to be set up and with a reduced section, to cut down on weight, where there are no stresses. All of the holes are cored and later reamed and tapped in special fixtures. This insures that all of the holes are exactly perpendicular to the face of the door when the jig is in place.

The edge guide, also an aluminum die casting, has all of its holes cored in the casting operation. On this piece, the 15/16" diameter guide hole is cast sufficiently close to size so that little, if any, clean up must be done on it. In the fixture which is used to ream the guide pin holes, this center bore is used for locating so

Continued on page 53

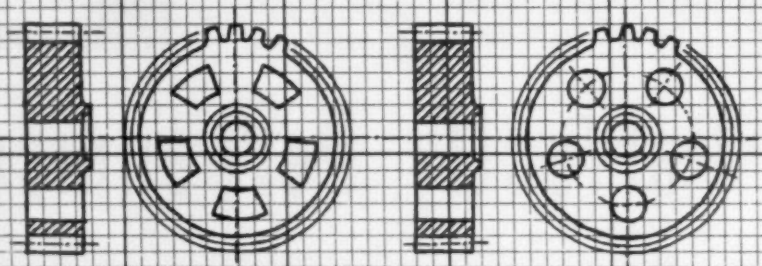
18 Design Pointers

for Powdered Metal Parts

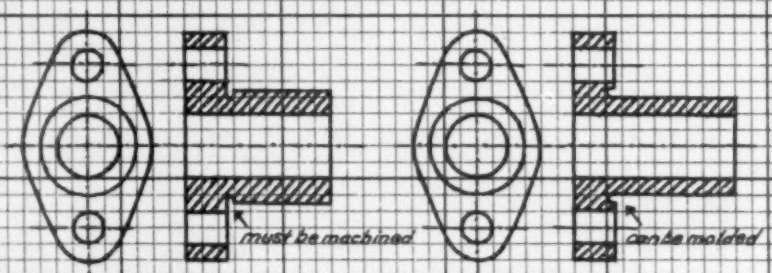
PREFERRED practice in designing parts that are to be produced by powder metallurgy is indicated in these sketches based on suggestions from several leading powder metal fabricators. These 18 favored design details cut the cost of powdered metal parts in several ways: 1) they permit less expensive tooling, 2) they eliminate secondary operations, 3) they speed up production rate, 4) they reduce the number of rejects.

UNDESIRABLE DESIRABLE

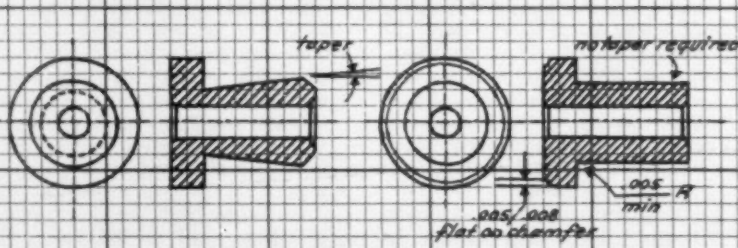
Round holes simplify tools, reduce cost.



Molded corner relief will save machining.

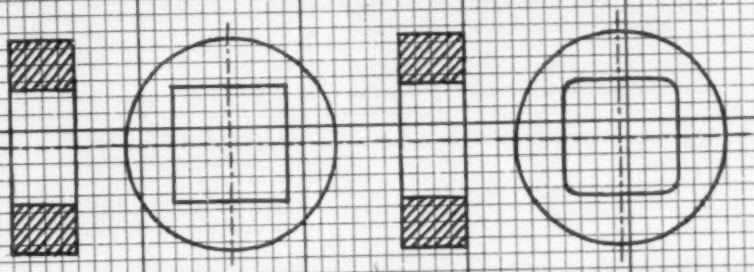


Reverse taper cannot be molded, must be machined.

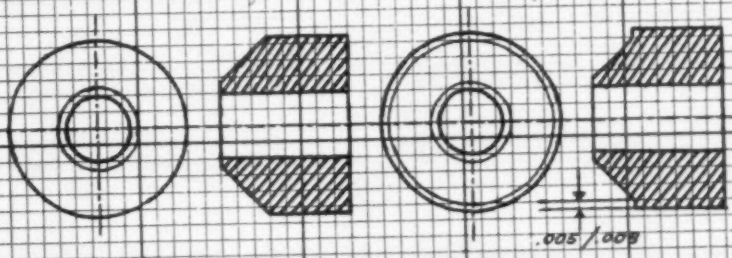


UNDESIRABLE

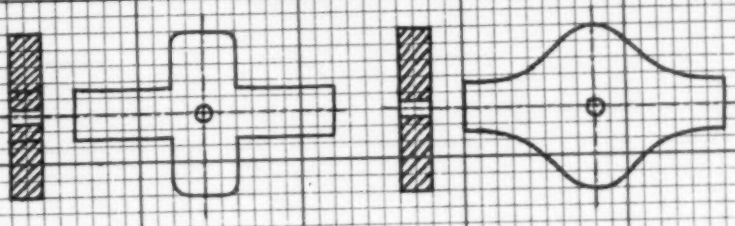
DESIRABLE



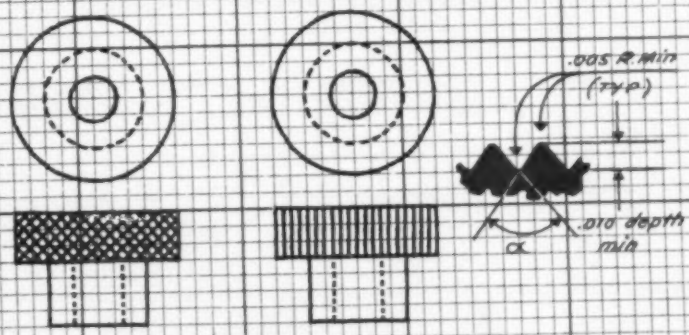
Rounded corners permit uniform powder flow in the die.



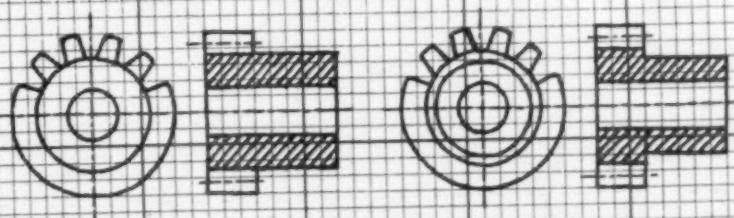
Flats eliminate sharp edges on tools and strengthen die.



Avoid designs requiring narrow, deep splines in the die.



Straight serrations can be molded, diamond knurl cannot.

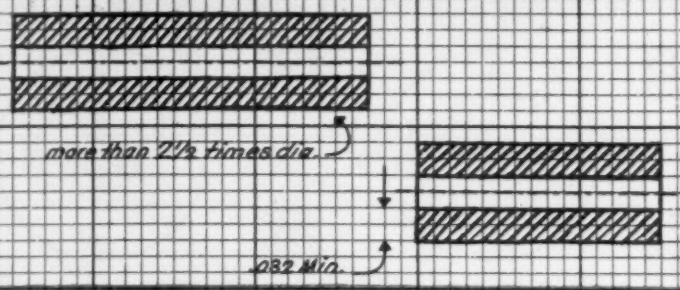


Gear hub should not be the same dimension as root diameter of gear, Possible, but costs more

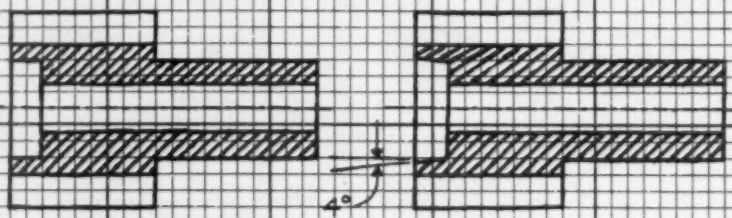
UNDESIRABLE

DESIRABLE

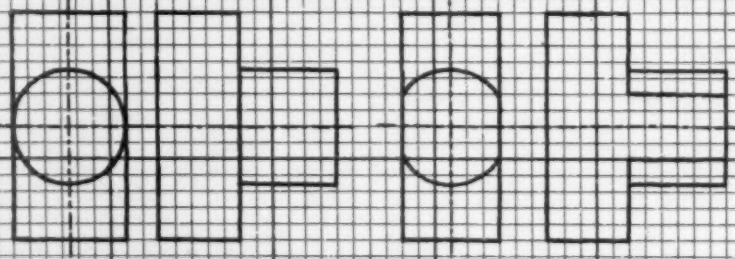
Length should not be greater than 2½ times the diameter.



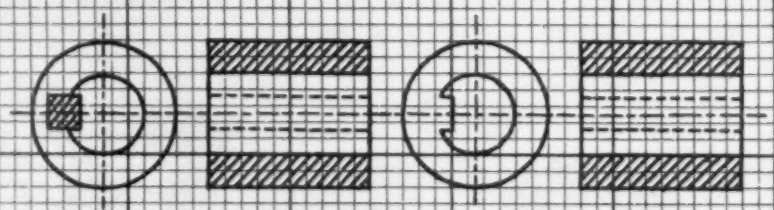
Tapered counterbore assists tool removal.



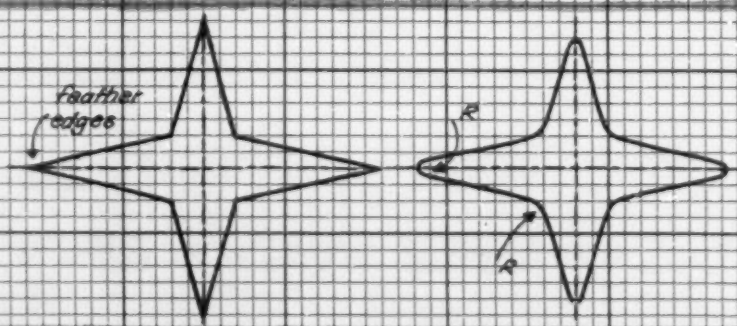
1/32" Minimum flat is necessary on cylindrical portion.

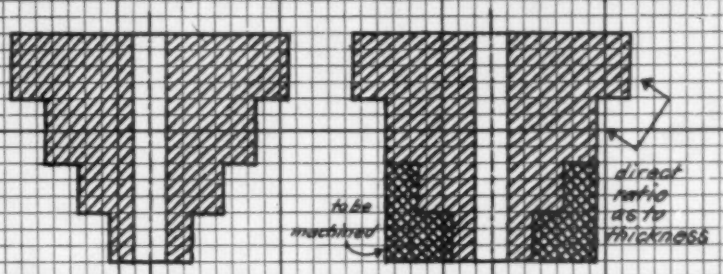
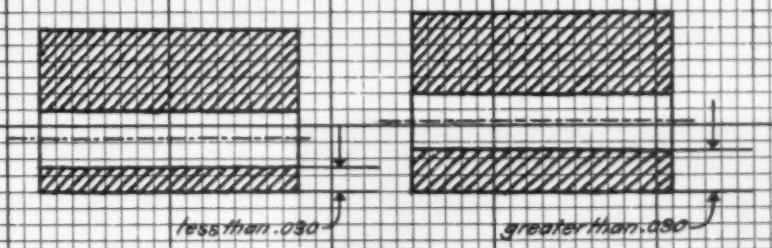
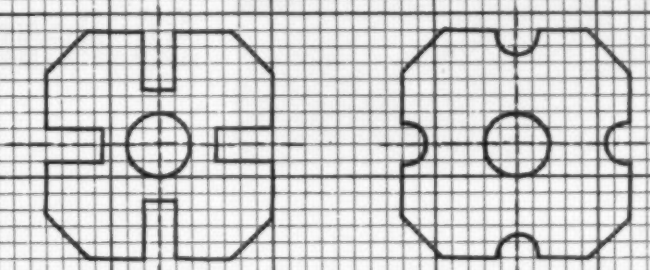
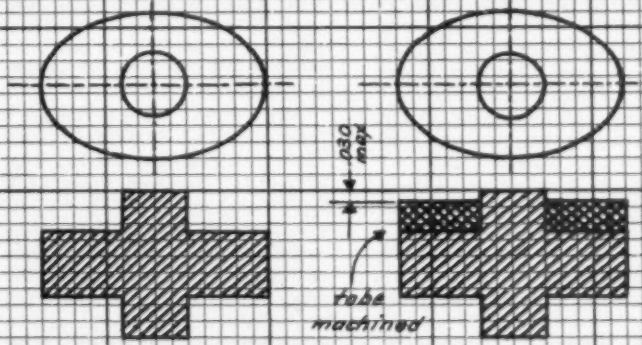
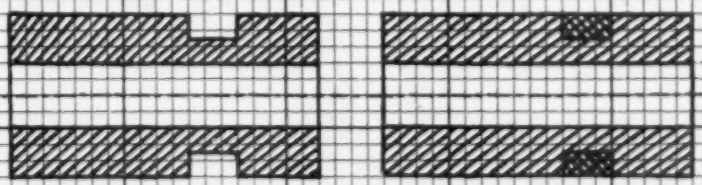


Eliminate separate key and keyway. Keyed bushing can be molded

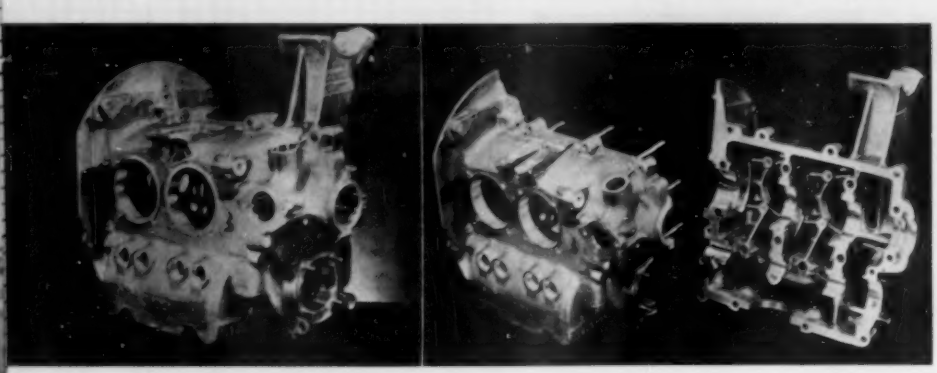


Feather edges on the part should be avoided.

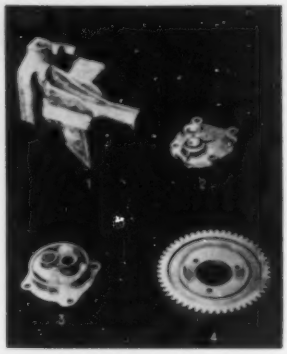


UNDESIRABLE	DESIRABLE	
		Lower strength results if all stepped dia - meters are molded.
		Side walls should be thicker than .030.
		Avoid narrow, deep splines in the part.
		Powder will not flow into upper punch.
		Undercuts cannot be molded, must be machined.

THANKS are due to: Chicago Powdered Metal Products Co.; Chrysler Corp. Amplex Div.; Keystone Carbon Co., Powder Metal Parts Div.; Kwikset Powdered Metal Products; The Yale & Towne Manufacturing Co., Powdered Metal Products Div.



CRANKCASE HOUSING is made up of two separate magnesium castings weighing a total of 20.5 pounds. Wall thicknesses do not need to be any thicker than would be required in an equivalent gray iron casting. Two cast halves are assembled by means of 25 threaded studs, screwed mechanically into the casting in a single operation. The camshaft runs directly in the magnesium bore without bushings.



FOUR SMALLER CASTINGS include: 1) transmission support bracket; 2) steering gear cover; 3) oil pump housing; 4) camshaft timing gear.

36 Pounds

The Volkswagen passenger car has a curb weight of 1,600 lbs. It will carry 4-5 passengers plus luggage or a payload of 850 lbs at a top speed of 70 mph. It is powered by an air cooled opposed piston engine having a displacement of 72.7 cu in and delivers 36 HP at 3,600 RPM. It is a rear engined car with rear wheel drive and all wheels have independent springs.

Like many small European cars the Volkswagen is designed for economical operation and it possesses a good ratio of useful load to car weight. On the commercial van and microbus, ratio is still higher.

The curb weight of this bus is 2,400 lbs and it will carry 1,700 lbs payload or 8 passengers plus luggage. In the case of the van, the ratio is 2,100 to 2,000 lbs.

The use of such very light metal as magnesium contributed a great deal in producing this light and economical car. Various considerations which practically necessitated the application of light metal in the heaviest units of these cars—that is the engine, rear axle and transmission assembly—should be pointed out.

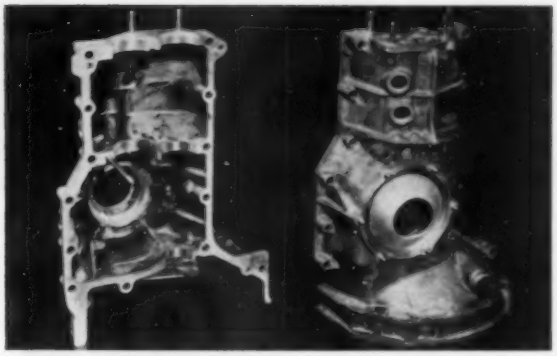
The car has the engine in the rear and on rear engined cars the designer always fights for good weight distribution which is so vital and important to the behavior of the car on the road.

The weight of the power and drive unit is 270 lbs. The engine alone weighs 170 lbs. For ideal steering control and directional stability one wants a little more weight on the front axle than on the rear axle. In the case of the rear engined car, this is difficult to achieve.

Although the power and drive unit is of short and compact design and the overhang reasonable, it cannot be helped that the load on the rear axle is greater than on the front axle. The weight distribution is 45:55 with two passengers in front and 42:58 with four passengers and luggage. It is our experience that this ratio must not be exceeded if satisfactory control of the car is expected.

Now you can see why we use a total of 36 lbs of finished magnesium castings on our car, but, of course, the application of a light metal alone does not make a satisfactory rear engined automobile. Size and weight of the remaining components of the power plant and drive unit must be tailored to the car to give a satisfactory overall performance.

Yet if the magnesium parts would be made from cast iron, 110 lbs would have to be added to the weight of the car which is a 7 percent increase. Since this is all in the rear, it would also have a very detrimental effect on the handling characteristics of the car. That is one of the reasons why in the past so many bigger rear engined cars were a failure.



TRANSMISSION HOUSING is built of a pair of castings whose total weight is 13.5 pounds. The company is now converting these from permanent mold to die castings. Thermal expansion of the castings required design compensations in order not to interfere with meshing of gears.

DIE CASTINGS

PERMANENT MOLD CASTINGS

American car builders can learn some of the advantages and problems encountered by a German automotive company now using . . .

Of Magnesium Castings Per Car

By LUDWIG C. BOEHMER
Chief Engineer
Volkswagenwerk, Wolfsburg, Germany

Crankcase Design Features

The combined weight of the machined crankcase halves is only 20.5 lbs principally because wall thicknesses and sections are not heavier than would be necessary on an equivalent gray iron casting. The crankshaft runs on four main bearings which are made of aluminum tubing and only the bearing No. 2 from the front is split, while the rest are circular one piece bearings. The camshaft runs directly in the crankcase bore and no bushings are used.

This shows that magnesium has also excellent bearing qualities and we have never experienced any difficulties with this design. If for some reason reboring is necessary, the face of the two halves is machined off about 0.010 and then the assembly with the original bearing diameters rebored.

A great number of threaded studs are used in the crankcase design and it may be worth mentioning that all these—a total of 25—are screwed in mechanically in one operation. This shows the excellent machining qualities and the ease of assembly when magnesium is used.

Rear Axle And Transmission Housing

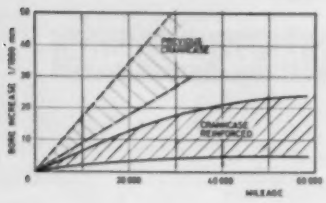
The weight of this housing, which is also of the split design, is 13.5 lbs without studs. It contains the gears and shafts of a 4 speed synchromesh transmission as well as a complete differential, ring gear and pinion with swinging half axles. The assembly is bolted directly to the engine.

Other magnesium castings used on the Volkswagen, include (1) Transmission Support Bracket—weight 1.4 lbs.; (2) Steering Gear Cover—weight 0.19 lbs.; (3) Oil Pump Housing—weight 0.24 lbs.; (4) Camshaft Timing Gear — weight 0.53 lbs.

The magnesium alloy which we use for all our castings is similar to the SAE composition 501A. A small amount of beryllium is added to the metal. This has the same effect as the previous method where sulphur was used to prevent oxidation of the metal. Since we are adding beryllium, complaints of our foundry men about sulphur dioxide have been almost nil. The physical properties of this alloy are sufficient for all our purposes, and it is our opinion that satisfactory automotive units can be designed in magnesium provided one knows the different behaviors of this metal.

All our engine crankcase halves are cast in permanent molds which produce a smooth casting practically free of porosity. About 120,000 castings are made from one mold before reworking is necessary. Disadvantage is the

Continued on next page

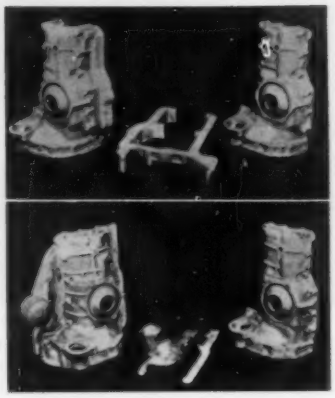


EFFECT OF CRANKCASE reinforcement on increase of main bearing bore due to pounding of crankshaft is illustrated.

COMPOSITION	
ELEMENT	%
ALUMINUM	7.5 – 8
ZINC	0.1 – 0.8
MANGANESE	0.1 – 0.5
SILICON MAX	0.3
COPPER MAX	0.2
BERYLLIUM	0.0005 – 0.0025
MAGNESIUM	BALANCE

PHYSICAL PROPERTIES	PERMANENT MOLD CASTINGS	DIE CASTINGS
YIELD STRENGTH, PSI	14 000 – 19 000	17 000 – 20 000
TENSILE STRENGTH, PSI	28 000 – 31 500	31 500 – 34 000
ELONGATION IN 2.5 IN., %	3.25	2
BRINELL HARDNESS (500 kg, 10 mm)	54 – 58	60 – 64

COMPOSITION AND PROPERTIES of VW magnesium alloy are comparable to SAE 501A. Note presence of beryllium.



36 POUNDS OF MAGNESIUM CASTINGS—Continued

great amount of waste metal in the form of deadheads and feeders, approximately 70 percent of the final weight, which later has to be trimmed off. Therefore, we are rapidly converting to the pressure die casting method and most of our transmission housing and other small parts are now cast that way.

It took many years before we learned how to overcome the inherent disadvantages of magnesium as compared to gray iron or aluminum, namely the high coefficient of thermal expansion and the lower modulus of elasticity. On account of these properties it was difficult to maintain in our engine a constant main bearing clearance which is imperative for quiet running and durability of crankshaft and bearings.

Since magnesium expands more than twice as much as steel, as a rule all bearing clearances must be somewhat larger than for gray iron or aluminum designs.

Of course, widening of the bearing would have been the best solution, but under no circumstances did we wish to affect the interchangeability of our parts. We know that very good results can be obtained with steel backed tri-metal main bearings as our latest experiments show. With this design bearing clearances can be reduced and we may go to this construction in the near future. Similar observations were made on our transmission and rear axle assembly where the high thermal expansion of the casting caused difficulties in the proper meshing of the ring gear and pinion.

TRANSMISSION HOUSING	PERMANENT MOLD CASTING		DIE CASTING	
	WEIGHT LBS	PIECE TIME MINUTES	WEIGHT LBS	PIECE TIME MINUTES
LEFT HALF CASTING				
WEIGHT INCLUSIVE RISER	18		15.4	
WEIGHT TRIMMED	8.5		7.2	
FOUNDRY TIME		32		21
RIGHT HALF CASTING				
WEIGHT INCLUSIVE RISER	13.9		13.2	
WEIGHT TRIMMED	7.0		6.6	
FOUNDRY TIME		32		20
BOTH HALVES MACHINING AND SCREWING IN STUDS TIME		19		15
TOTAL FOUNDRY AND MACHINE SHOP TIME		83		56

COMPARISON is made between permanent mold castings with riser (top) and die castings with feed head (below) with regard to weight and piece time.

Special tooth forms and contours which are less sensitive to lengthwise variations had to be developed. This in combination with a correct arrangement of the thrust bearing and a heavily ribbed housing resulted in a quiet and durable transmission and rear axle assembly. It is nevertheless necessary to make continuous improvements in this respect, because we have increased the power of our engine steadily since 1950. We do not have a horsepower-race in Europe, but people want better performances even in small cars.

The pressure die cast machines which we use operate on the cold chamber principle which we think is preferable for our large and intricate castings. Each machine produces about 18 transmission halves per hour—that is a piece every 3 minutes. (Incidentally, approximately 1,500 complete transmission housings and engine crankcases are produced per day.)

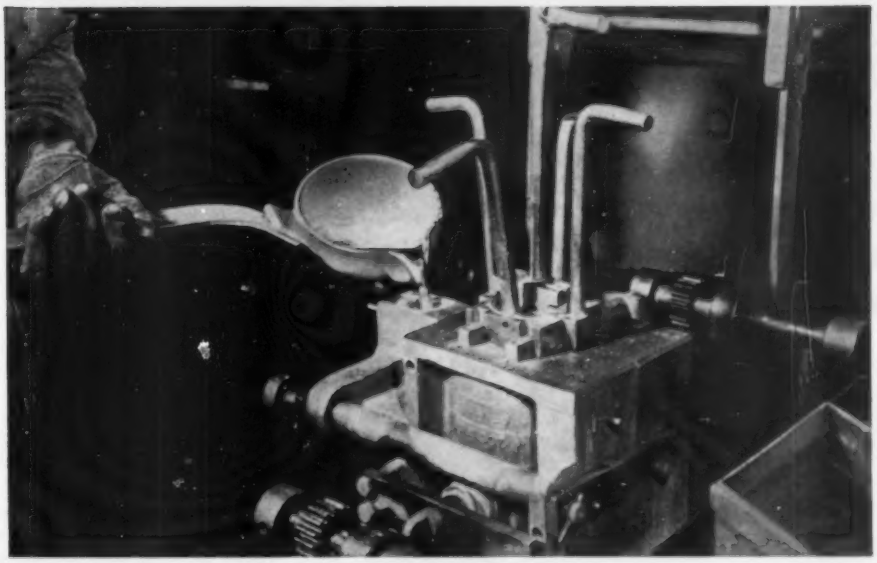
Continued on Page 44

VOLKSWAGEN PRODUCTION AND MAGNESIUM CASTINGS USED

YEAR	VEHICLES	TRIMMED CASTINGS METRIC TONS
1945	10,020	—
1946	8,987	—
1947	19,244	—
1948	46,154	—
1949	90,038	332
1950	105,712	835
1951	136,013	2,185
1952	179,740	2,732
1953	242,373	3,714
1954	330,000	5,095
1955	1,170,066	7,000
TOTAL		21,893

ANNUAL OUTPUT of cars and increasing use of magnesium castings, are charted above. The company buys magnesium in USA, Norway and Germany. Volkswagen's three factories in Germany employ 30,000 men.

dag DISPERSIONS



Use improved mold coatings to get better aluminum castings

Problems which arise in casting aluminum in permanent molds—over-rapid chilling, rough surfaces, sticking to the molds—are solved by the use of 'dag' dispersions.

'dag' dispersion No. 193 (vermiculite in water) is now widely used in the permanent-mold industry to provide a smooth, tenacious, insulating mold coating which allows the melt to remain fluid longer and flow better. Proper application of this valuable 'dag' dispersion produces a smooth, durable coating which gives first-class castings every time.

An overspray of 'dag' Colloidal Graphite on top of an insulating coating helps in ejecting the casting and prolongs the life of the vermiculite wash. Cores are usually coated with 'dag' Colloidal Graphite, and it can be used alone on molds when casting sections are relatively thick.

To get more information regarding 'dag' dispersions for insulating and lubricating coatings, write us and ask for Bulletin No. 425-N10.

Dispersions of molybdenum disulfide are available in various carriers. We are also equipped to do custom dispersing of solids in a wide variety of carriers.

ACHESON COLLOIDS COMPANY

PORT HURON, MICHIGAN

...also ACHESON COLLOIDS LIMITED, LONDON, ENGLAND

use 'dag' dry films for trouble-free lubrication

The castings are then loaded on a conveyer which passes through tanks of boiling water to preheat the pieces, continues through the pickling tanks and then they are rinsed and heated again for drying and inspection of cracks and other imperfections. After that the feeder is trimmed off on large circular trim saws which permit continuous loading and unloading. From there they go through the finishing trim line where all burrs are removed and after a final inspection are again pickled and shipped to the machine shop. The picture gives a plan view of our permanent mold and pressure die cast foundry.

The machining of these castings is done on special machines particularly designed for our purpose. They are mostly of the rotating table or drum type and each casting is individually loaded in the machine. So far we have purposely refrained from machining these parts on transfer machines, because the low modulus of elasticity permits harmful distortion and this definitely must be avoided.

Magnesium castings require a different approach when it comes to automation, but we think that due to our extensive studies we are near the solution. For instance, it is essential that the temperature of the casting during machining is held low enough and rather constant to prevent undesirable distortion and undue expansion. Since no liquid cooling can be applied, it is necessary to permit gradual cooling between single machining operations. We even avoid direct sun rays and keep the shop temperature low and constant

The ease and speed of the various machining operations and the cleanliness due to the absence of a cooling liquid is very attractive and has resulted in very efficient production. The life of the cutting tools is more than five times that on gray iron and machining time less than one quarter. Even when compared to aluminum, magnesium can be machined in about two-thirds of the time. Of course, it took some time before we learned how to adopt our methods to this difficult metal, but our men would not want to be without it.

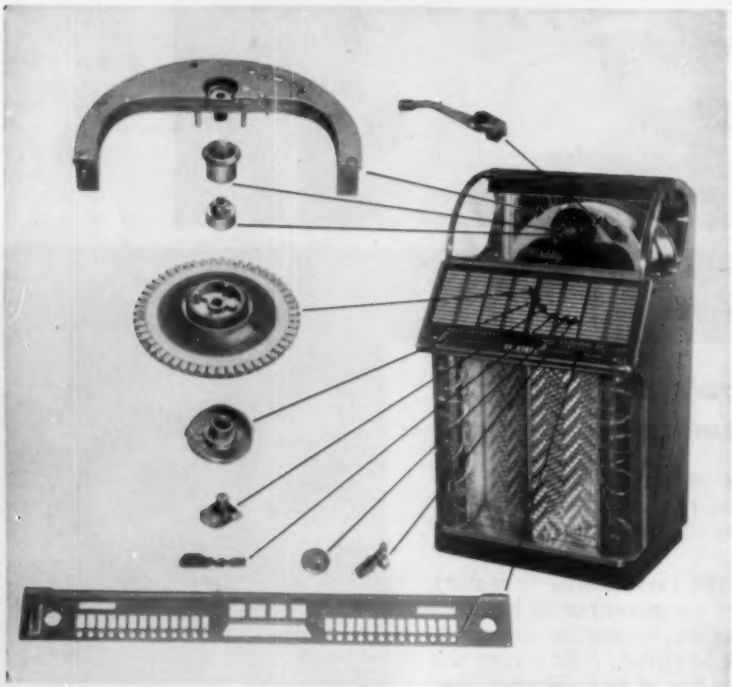
As you know, magnesium is inflammable and we make every effort to keep this danger to an absolute minimum. It is important that chips are not too fine and are quickly removed from the working piece. Cutting tools must be kept sharp with a great rake angle and a small cutting angle and even then the cutting speed must be limited to about 650 ft/min on precision boring.

In spite of all these precautions small local fires happen once in a while on a working piece and we use only gray iron chips as an extinguisher; no sand and certainly not water or foam. Since 1949 when we started with magnesium on a large scale no fires of any consequence have occurred.

There is no denying that the fine magnesium dust which develops during machining is very undesirable and every effort must be made for its removal or separation. Otherwise it may have an adverse effect on the health condition of the workmen. Therefore, thorough health supervision of our magnesium machinists is a strict rule and is carefully exercised.

Editor's Note: This material was presented before the annual meeting of The Magnesium Association in November.

ACCURATE Aluminum, Zinc and Magnesium Die Castings help WURLITZER



...produce an outstanding high fidelity phonograph at lower cost

■ To help maintain its reputation for high quality products that are competitively priced, the Wurlitzer Co. specified ACCURATE die castings. They were sure that every die casting would meet every specification. Cast to close tolerances, these castings required little or no machining, are light in weight, and are ready to use as cast.

Whether it's aluminum, zinc or magnesium die castings, ACCURATE is completely set up to help you with your requirements.

Contact us today for prompt action.

Aluminum, Zinc and Magnesium Die Castings

ACCURATE DIE CASTING CO.

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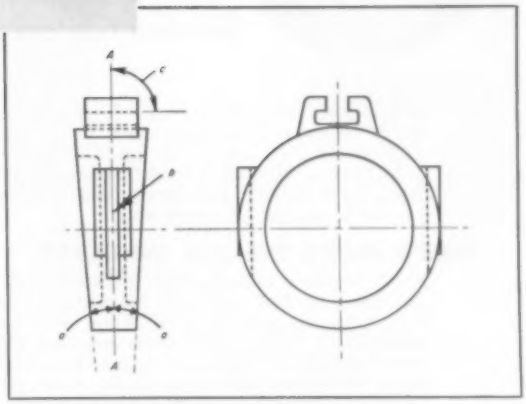
For more information circle No. 1 on the Reader Service Card

Forging and sand casting have been rejected as production methods for this large valve gate.



HOLDING THE ANGLES of the wedge faces (a) can be accomplished by shell mold casting because there is no shifting of shell halves. Only a light surfacing grind is needed. Most machining of other surfaces is also eliminated.

Close Symmetry Held In A 17-Pound Stainless Steel Wedge

BECAUSE of their inherently high first cost, forgings are seldom used unless the particular structure that results from the forging operation is an advantage. There are, however, some instances where the saving in both machining time and in the number of parts that are rejected due to porosity, blow-holes, inclusions, etc. that result from a sand casting make a forging more economical than a casting.

In those cases where the conditions cited dictate the use of a forging, there is now one more change in manufacturing methods that can often produce still further economies. This is a change to a shell mold casting.

As a specific example of the progression noted above, consider the wedge gate for a 4" valve made by the Kerotest Mfg. Co. This gate is made in both plain carbon steel and type 410 stainless steel and weighs about 17 pounds when finished. The particular wedge gate illustrated above is a shell mold casting in the as-cast condition.

There are several features about this valve wedge that make it a precision part, and the needed precision can be either molded in or machined in.

Referring to the sketch, if an imaginary plane "A-A" passes through the wedge, then this plane is the reference for almost all of the pertinent dimensions and tolerances. The two wedge surfaces must, of course, be finished to give the desired fit when the valve is closed. The angles "a" must be precisely equal and the same as the angle of the mating seat. Further, these wedge faces must be completely free of all imperfections that would allow erosion to start when the valve is only "cracked."

The groove "b" acts as a guide during the opening and closing of the valve and further acts to prevent chatter of the wedge when the valve is only partially open. To give proper guiding, the edges of the grooves must be parallel to the plane A-A which passes through the center of the groove.

The T slot at the top of the wedge is to receive the end of the stem by which the valve is opened and closed. Here the angle "c"

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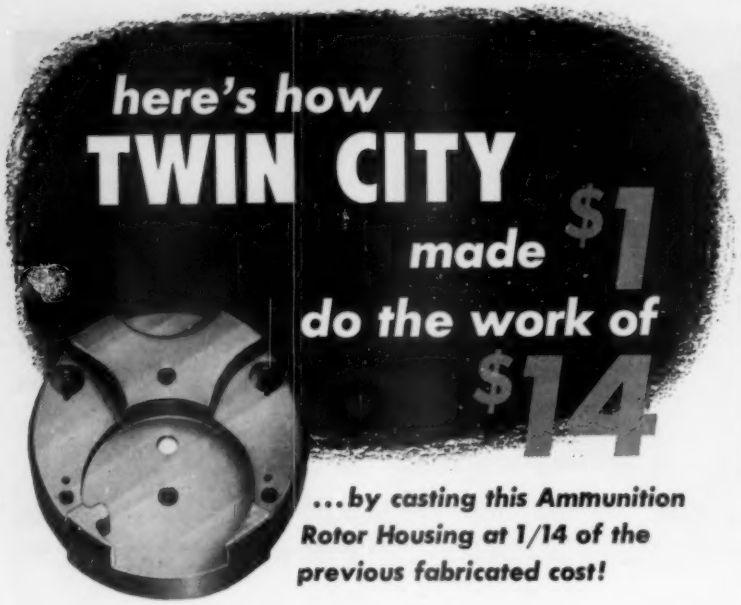
here's how
TWIN CITY
made $1
do the work of
$14
...by casting this Ammunition Rotor Housing at 1/14 of the previous fabricated cost!

Machined from brass in 1943, this rotor housing cost 14 times its present delivery price. Costs had to come down and production had to go up. Could die casting do the job? Several die casters said the small holes in the intricate housing made the job impractical. Costly machining *appeared* to be the only process.

HERE'S WHAT THE JOB INVOLVED:

Cast the rotor housing with a diameter of 1.307″-1.310″, a thickness of .486″ and with eleven cored holes in the casting, some as small as .040″. Four .0780″-.0790″ dia. holes and 2 holes .0945″-.0955″ were included. Counterbore cores were necessary. Tolerances had to be maintained and each hole had to be relative to every other point . . . a most exacting job with 41 separate gauging operations.

HERE'S HOW TWIN CITY HANDLED IT:

The die was made in Twin City's own shop. Special tooling was designed to insure uniformity of subsequent impressions. During casting, temperature of the dies was automatically controlled. Millions of rotor housings have been produced *to specifications* at approximately 1/14 of the machined cost at today's prices. Only in a shop where individual attention is given can a job of this kind be successful.

HOW TWIN CITY CAN CUT YOUR COSTS:

Twin City's experience on countless tough jobs, plus its ability and willingness to work with your engineers can help you show *new* profits on the products you make and sell. Oldest die casters in the Upper Midwest, Twin City welcomes the opportunity to show you how precision die casting can pay off for you.

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must be at 90 degrees to plane A-A to prevent binding and undue distortion of the stem during opening and closing operations.

Naturally, the thickness of the wedge gate must be held to close tolerances.

Now consider the manufacture of this wedge gate by the three methods mentioned, sand casting, forging and shell mold casting.

Sand Casting

Obviously, all of the major structural details of the wedge can be cast. The accuracy of the angles "a" and "c" cannot be held within the required tolerances nor can either the thickness of the wedge or the size and parallelism requirements of the groove. As a result, a sufficient amount of stock must be left on the two faces to bring them within finished dimensions by grinding. Further, the grooves must be shaped and brought to size by milling as must the hanger. All of these operations are expensive, particularly the milling operations.

Further disadvantages of a sand casting for this part are that no reference plane exists from which machining operations can be started and, due to the large amount of metal that must be removed, the likelihood of uncovering sub-surface defects that will cause rejections is great.

Forging

Some improvement as far as cost of machining is concerned is achieved when the wedge is forged. Not all of the structural details can be included in the forging, but the basic accuracy is sufficiently improved so that less metal needs to be removed. Further, because of its superior structure, the number of rejected parts is very greatly reduced.

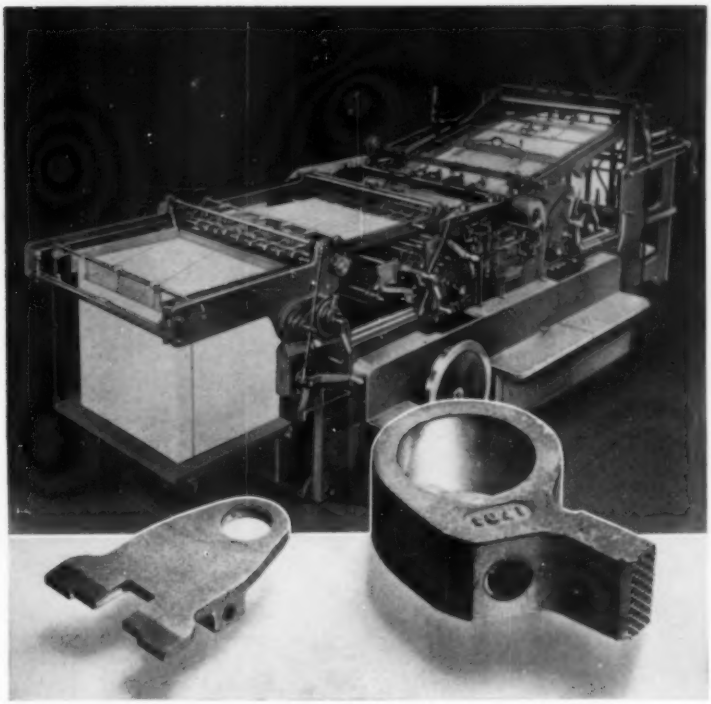
The expensive milling operations have not been eliminated by converting to a forging. However, the amount of metal that must be removed is less and location for the start of machining operations is somewhat simpler.

Shell Mold Casting

As a shell mold casting, all of the advantages of both sand casting and forging can be secured

Continued on page 80

Long Life Components In High Speed Equipment



1. WHERE WEAR RESISTANCE is a problem and to reduce high machining costs, investment castings may prove to be the solution. Two of the several used in printing machinery are shown. The guide brackets, lower left, and the gripper pad, lower right are typical.

BY CARL SIEBKE
Chief Engineer
Miller Printing Machinery Co.

Precise timing, in terms of thousandths of a second or less, is the secret of successful operation of a modern high speed printing press. Particularly is this precise timing required when a multicolor press is involved. Couple this requirement with ultra-smooth operation since vibration and shock reversals cannot be tolerated, and the magnitude of the design job faced by the engineer becomes apparent.

But these considerations are not the only ones that must be faced. Ruggedness is paramount. A modern printing press may not fail. Regardless of the sort of material being printed, time is always of the essence and a press breakdown can well mean the difference between success and failure for the individual or company who depends on the printer to get the job done on time.

Then too, these high speed presses are expensive and the purchaser has every right to expect them to operate in a trouble-free manner for long periods of time. Because they realize all of these factors, the Miller Printing Machinery Co. has utilized every method of fabrication that will give them the sort of product required and still allow their presses to sell in a highly competitive market.

In these presses, therefore, both investment castings and die castings, zinc and aluminum, are used to give the best functioning part.

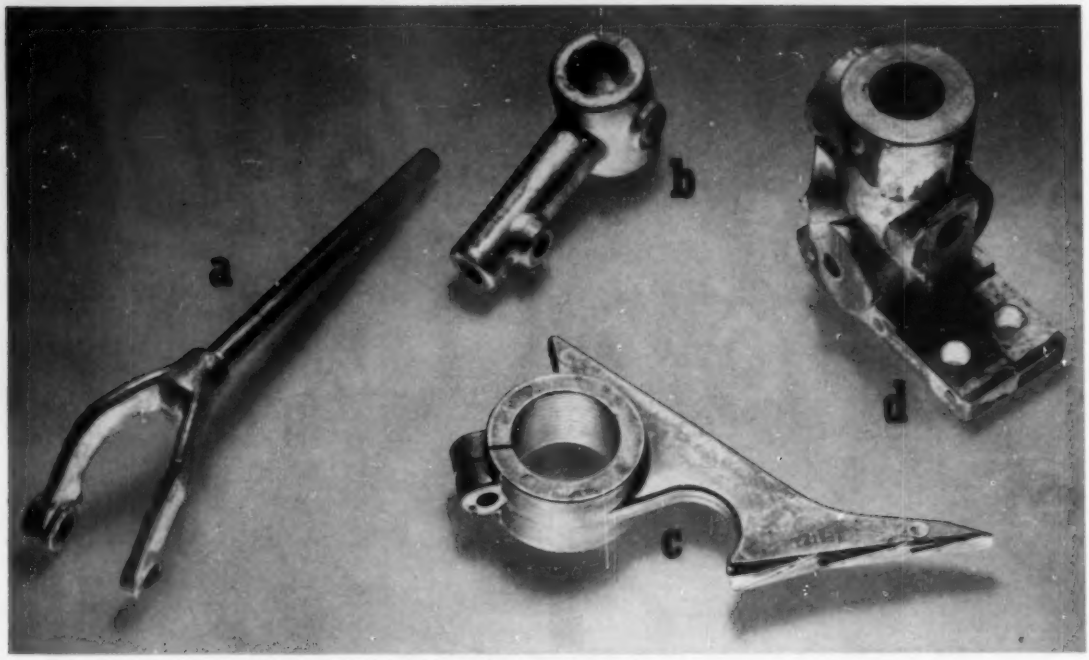
The Investment Castings

Only two of the investment castings in use are shown. The front guide bracket, Figure 1, maintains front register of the sheet of paper. In this operation, the individual sheet of paper is carried forward until the front edge is brought in contact with the guide bracket. While it is held in register against this bracket, the sheet is also shifted sideways to secure proper side register.

Because of the abrasiveness of some paper stock, this operation could cause severe wear on the register surface of the guide bracket, if it were not made of suitable material with sufficient hardness. As soon as the sheet is completely registered, the guide bracket lifts and allows the sheet to proceed.

Due to the high wear factor on this part, it has always been made of hardened steel. Prior to the availability of investment castings, this guide bracket was originally designed as a forging. As such a part, the pivot hole and the large hole in the back had to be drilled and some 13 different

MANY DIE CASTINGS ARE USED



2. LIGHTWEIGHT, complex contours, lowered machining costs are some of the reasons why both zinc and aluminum die castings are widely used in printing machinery. In each case illustrated, some specific design problem dictated the use of a die casting.

surfaces machined; both grinding and milling operations were required.

By conversion to an investment casting, the machining operations have been reduced to two very simple inexpensive ones. The pivot hole is still drilled and a light grind taken over the bevel on the front to insure exact angular relationship and desired smoothness. As the part is cast, it has an approximate surface roughness of 125 microinches which is adequately smooth for this part, with the exception of the beveled surface.

The other investment casting illustrated is a gripper pad, Figure 1. Formerly a forging in mild steel, it is now investment cast in aluminum bronze. The knurled surface shown is as-cast and the only machining required is to ream the large bore and tap the side hole for an adjustment.

In the case of each of these investment castings, the new manufacturing method has given a superior product at a reduced cost.

The Die Castings

As in the case of the investment castings, only a few of the many die castings used on these printing presses are illustrated. These castings fall into two general classes: those where weight is not a matter of any moment and the other where the mass of the part must be kept down due primarily to the need of rapid and smooth reversal in the direction of motion.

The upper tape bracket and the upper tape pulling bracket, Figures 2a and 2b, are strictly structural and, as long as they have adequate mechanical strength, the only requirement is minimum manufacturing cost. Both parts were originally designed as zinc die castings. In the cast of the tape pulling bracket, the steel rod is a cast-in insert in the die casting. This rod has flats machined into it to insure adequate anchorage of the die casting on the steel. The bracket is used as-cast except to drill and tap one hole for a set-screw.

On the tape bracket, which fastens to the other end of the cast-in rod noted above, the large pivot hole and the hole to accept the rod are both reamed. The threaded set-screw holes are cored in the casting and later tapped.

On neither of these castings is any surface finishing other than normal trimming required.

The stripper finger, shown in Figure 2c, is an aluminum die casting. This part guides the paper at the instant the grippers release it to the paper conveyor. It is an oscillating member operating at about one cycle per second, with an amplitude, at the tip, of about ½ inch. While

Continued on page 80

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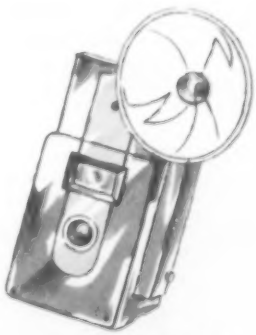
You can have any aluminum part bright anodized, whether stamped, forged, drawn, or extruded.

Already designers are seizing the idea...

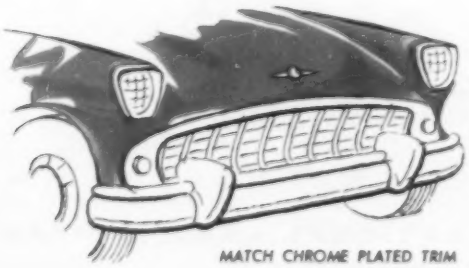
For instance, gay frames for eyeglasses are now bright anodized. So are exciting new coffee makers...and a number of colorful houseware items.



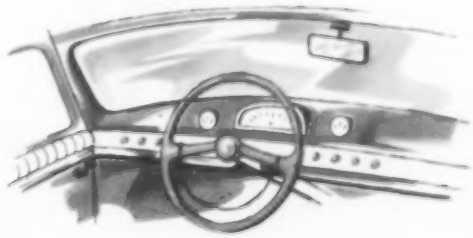
ACID RESISTANT AND NON-FADING

That's only the beginning. Bright anodized aluminum is replacing heavy chrome plated grilles in several style-setting new automobile models now in production or planned. The blend with chromed body trim and bumpers is said to be perfect...cost and front-end weight much lower.

Maybe this will answer that problem we discussed at lunch yesterday.



MATCH CHROME PLATED TRIM



BLEND WITH INTERIOR UPHOLSTERY

In the appliance field, one leading range maker is bright anodizing control knobs and emblems. And bright anodizing is also being used to re-style refrigerator and other kitchen appliance hardware...in color.

So it goes. Think what might be done to give dash boards new dash! And maybe we'll soon see a car "gold-trimmed" throughout. We've sketched other possibilities and you'll think of more -- instrument bezels, tubular furniture, window frames, perhaps. TV sets? Cameras?

Let's take a new look at our whole line

And your products? Doehler-Jarvis is ready to stamp, forge, extrude, or draw aluminum parts and bright anodize them for you. Maybe, too, we can give an "assist" on design.

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Sincerely,

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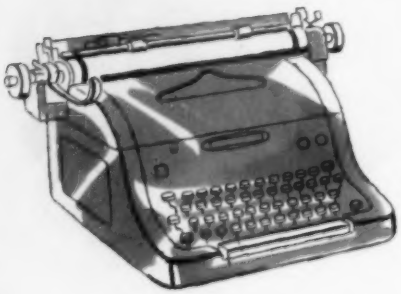
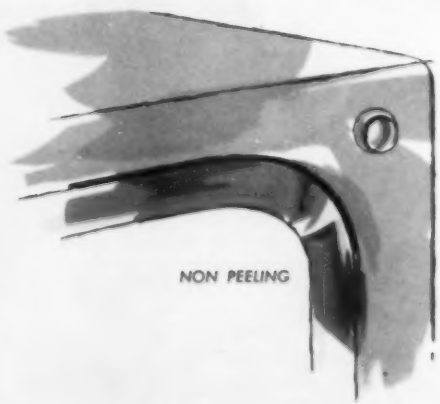
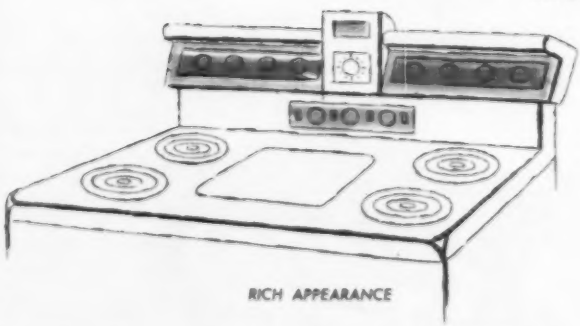
I'll be in Chicago this week. See if you can set something up for the week following.
R.T.







DOEHLER-JARVIS DIV. OF NATIONAL LEAD COMPANY

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Recommended Melting Practice For Small Heats

Part Two

By DR. NICHOLAS J. GRANT
Associate Professor of Metallurgy
Massachusetts Institute of Technology

(Editor's Note: In Part One of this paper, originally prepared for the Investment Casting Institute, Dr. Grant outlined the general and specific problems of melting small batches for investment casting.)

WITH the preceding outline to serve as a broad discussion of the problems one must meet, a recommended practice for 5 to 20 pound melts is as follows, based on a number of prior conditions.

Conditions

1. Stainless steel castings, type 321 (titanium stabilized) with a melt of 10 pounds required for one flask.
2. Small motor-generator high frequency set for about 30 KW at 10,000 cycles. Magnesia crucible.

Recommended Practice

1. Select sheared bar stock, cut if possible short enough so that the ends do not stick out of the crucible very much; or cut for a minimum of exposure, since exposure increases heat losses to the atmosphere. Make sure bar stock is free of grease and is dry.
2. Use type 304 stainless steel instead of type 321.
3. Melt at maximum power but make sure bridging of the charge does not occur, since bridging would result in overheating of the molten bath at the bottom of the crucible.
4. If stainless scrap is available and is of proper high quality, add it as the charge melts so that the scrap, which is often bulky and irregular in shape, heats up with the descending charge and does not chill the molten bath excessively on sinking into the melt.
5. As soon as the charge is molten, check the temperature by the best means available to you to avoid overheating.
6. Based on your practice, you will have lost probably one and at the most, with poorer practice, 2 percent chromium. The melt will have picked up some oxygen (about 0.02 percent), some nitrogen (possibly 0.01—0.02 percent), and will have lost about 10 percent of the manganese and 40 to 60 percent of the silicon. Neither the manganese nor the silicon loss are of concern and nothing can or should be done about the nitrogen increase unless you suspect that the pick-up is larger, in which case your titanium requirement will be higher for stabilization.

After an addition of about 0.03 percent of calcium silicon metal to deoxidize by plunging under the surface, having made sure the temperature is about 2850 to 2900 F, make an addition of 2 percent chromium to adjust for oxidation losses, add an adjustment of electrolytic nickel to make an 18 chromium—10 nickel composition (see below).

If an oxide skin appears to be forming, add about 0.02 percent Ca-Si metal, and immediately thereafter add about 0.9 percent titanium to attain carbide stabilization (0.08 percent carbon × 6 or 7 titanium = 0.5 to 0.6 titanium required) as a good grade of nickel — 30 percent titanium.

The 70 percent of the nickel in the nickel-titanium addition should be adjusted by pure nickel to reach the 10 percent specified above. Your titanium addition should give a recovery of about 75 percent with prior deoxidation if the temperature is not too high and the melt can be poured almost immediately thereafter. Immediately after the nickel — titanium alloy is in, add again either 0.2 percent CaSi metal or 0.2 percent Misch and pour, again checking the temperature.

Variations

1. If two or three flasks are to be poured from the same melt, the titanium loss will increase with each flask poured, in that case a safer addition would have been about 1.0 percent titanium.
2. On direct (static) pour, try to pour as cold as you feel you can safely fill out the casting, for example, 2800 F or possibly 2850 F at the most.
3. If repoured into a centrifugal casting machine, pour slightly hotter to allow for a temperature loss, but also add an additional 0.1 or 0.2 percent of titanium to provide for increased losses over a single static pour.
4. If type 321 stainless stock were chosen for remelt, essentially all the titanium would be presumed to be lost and deslagging would be required. Additions of titanium would follow the above schedule. Oxidation of other elements in the presence of the titanium would probably be less and no more than about 1 percent chromium would have been lost. The initial deoxidation step would not be necessary.
5. With a carbon-arc furnace, carbon pick-up would occur and a higher titanium addition would be required to give stabilization against carbide precipitation and intergranular corrosion.

Continued next page

Temperature Control

For temperature control several methods are available:

1. *Optical pyrometer.* The readings can be extremely misleading if one sights on slag or oxide skin surfaces as compared to the molten metal surface. Precautions must be taken to calibrate for significantly dissimilar alloys and for different temperature ranges. More than one reading is required.
2. *Immersion thermocouple.* These certainly give the most reliable and reproducible readings with proper calibration and precautions against contamination. Silica protection tubes are somewhat expensive and discourage taking more than one or two fast readings per heat. For very high temperature work (greater than 2800° F) contamination becomes a greater factor and more frequent cut-backs to clean wire are recommended.
3. *Immersion rods of the same alloy.* A cheap relatively rapid temperature estimate can be made by using a wire or rod of fixed diameter of the same alloy or a similar melting point alloy as the melt. The time to melt off the tip, deeply immersed, is a measure of the higher temperatures. A build-up of solidified metal tells that the metal is very cold.

Control For Hydrogen

If porous castings are obtained which can be correctly associated with hydrogen evolution on solidification, one or more of these steps will aid in eliminating much of the hydrogen:

1. Flush with *dry* argon or helium, using very small openings in a silica tube. If the crucible is full of metal, splashing becomes a problem.
2. Clamp on a vacuum head over the top of the furnace if this is at all possible. The furnace design may be modified to permit this. Even a very poor vacuum will help.
3. Reoxidize the melt using nickel oxide or iron oxide; the oxygen will remove hydrogen. Then deoxidize and pour quickly.

Alloy Additions

Precision casting, small melts, requires the development by the industry and its suppliers of new grades of ferro-alloys and master alloy additions to simplify and speed up alloy control. Since one is frequently faced with the problem of buying alloy grades of wrought composition already within an AISI, AMS, SAE or similar specification, but is also faced with the inevitable melting losses, provision for adjustments must be made. Sizing of ferro-alloys and master-alloy additions is important to permit more gradual additions which will not chill the metal bath, but powder grades are undesirable because of lumping. In this respect, definite important steps are already being taken.

Summary

While small heat practice presents many headaches, there are preferred methods of melting and deoxidation which can minimize many of the more serious problems. An awareness of the magnitude of the problem is the first prerequisite. A knowledge of the losses of elements for a given practice is a necessary first step. After that, close control and a constant realization of the pitfalls associated with variable practice should suffice to minimize the difficulties.

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PERFECTLY PERPENDICULAR
continued from page 35

that the guide holes are properly positioned when reamed.

The two guide pins, the clamping screw and the lock screw are steel screw machine parts. The handles are die cast aluminum also.

Thus, through the use of properly designed aluminum die castings, a tool has been created that has all of the accuracy needed, is adequately rugged, light in weight and low in cost so that lock sets can be installed rapidly, easily, neatly and without highly skilled labor.

One other operation must be done installing a lock set. The strike plate must be mortised into the door frame and the face plate mortised into the edge of the door.

Experience has shown that, if a neat job is to be done, the outline for the mortise can not be left for the individual carpenter to determine. Usual practice is to hold the plate in place and draw around it. This procedure usually results in a mortise that is too large for the plate and often with chipped edges.

To overcome these faults, a tool has been devised as shown in Figure 1. The outside of the cutters is the exact size for the mortise of a Dexter faceplate or strike plate. The center pin is 15/16" diameter to fit the hole that has been bored in the door to take the tubular latch and, so that it may be used to set strike plates, is spring mounted to retract into the body of the cutter.

In use, the carpenter positions the cutter properly and strikes the shank with a hammer. The steel cutters mark the mortise exactly. This tool must, of course, have all of the same characteristics as the boring jig.

To accomplish the desired end result and still have a low cost, durable market, the body is also die cast aluminum. Five holes are drilled to mount the cutters and the center guide installed in a previously cored hole.

On both tools, no surface finishing is required other than to remove all burrs and flash that might be left after casting and trimming.

"Sorry to interrupt—but the boys are having trouble with the aluminum melt again"

Yes, aluminum can get "balky". Especially when melting conditions are conducive to absorption of Hydrogen. Also good gating and risering is vital to reducing other porosity, such as trapped air and internal shrinkage.

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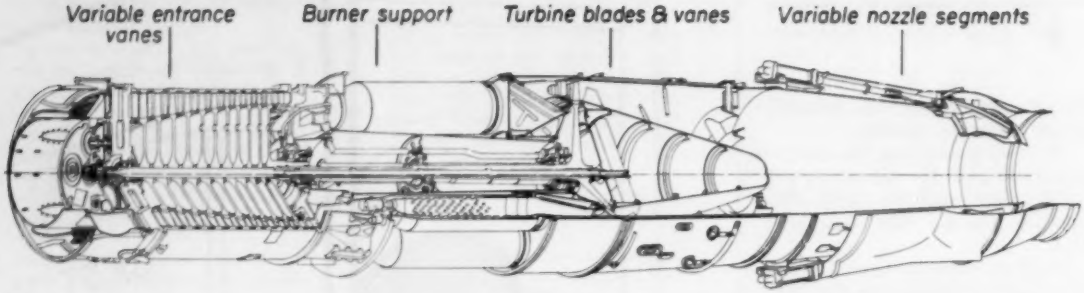
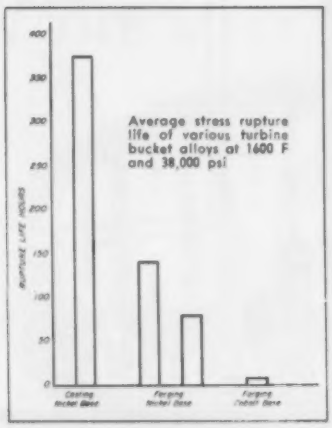
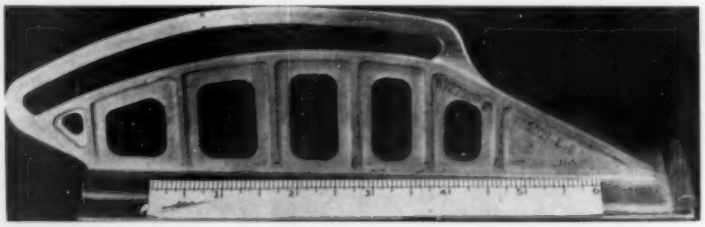


1. WHERE INVESTMENT CASTINGS ARE USED in typical aircraft turbines is indicated above, although not all of them are used on the particular engine illustrated. In this Allison J35 turbo-jet engine, turbine blades and vanes are investment cast.





2. SUPERALLOYS COMPARED, left, show how experimental nickel base castings rate against currently available nickel and cobalt base forgings.

3. COMPLICATED CONFIGURATIONS now being investment cast are indicated by the variable nozzle of an afterburner, above, cast in 310 steel.

Gas Turbines: Where

THE tremendous increase in production quantities of investment castings in the last 15 years has largely paralleled development of the gas turbine engine. With this continued expansion, there has also been a growing industry recognition of the further need for technical improvements that will result in higher casting quality and therefore broader applications.

Design personnel are fully cognizant of the diversified casting configurations which can now be incorporated in their forward engines and must have the assurance that the part will be engineered in the foundry with full consideration of performance and durability. In a discussion of current applications on aircraft turbo-jet and turbo-prop engines, let us consider the criteria for choice of castings by the metallurgist in retrospect of forgings.

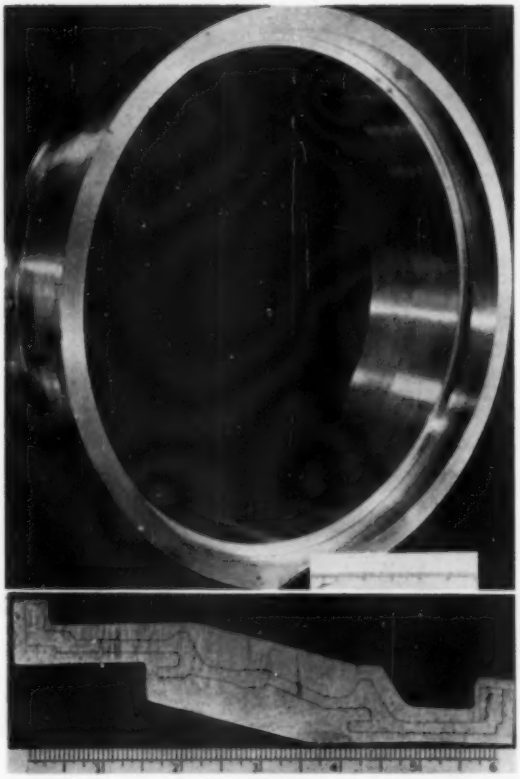
The primary considerations have been the following, and we shall enlarge upon them when covering specific items: 1.) Design or configuration; 2.) Engineering requirements; 3.) Quality; 4.) Productivity; 5.) Cost and /or alloy utilization.

Current Applications

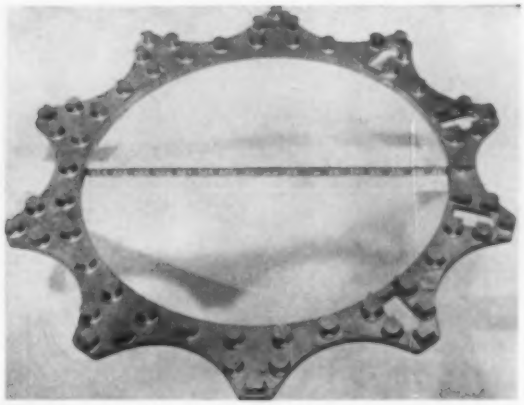
At the present time, investment cast parts are largely confined to the hot end of the gas turbine as illustrated in the photographs of typical turbo-prop and turbo-jet engines in Figure 1. These casting applications utilize the high temperature strength of both austenitic steel and super-alloys, the later comprising the most critical parts of the entire engine, turbine blades and vanes.

From a design standpoint, castings and forgings for some configurations of turbine blades are a "stand-off," but a careful comparison between recent cast nickel base alloys and currently available forging alloys shown in Figure 3 indicates that well designed castable alloys are most attractive to the engineer.

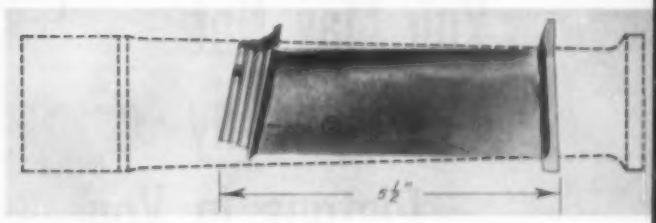
The minimum hot strength properties as measured by stress rupture tests indicate that the best cobalt base and nickel base forge-



4. POSSIBLE WEIGHT REDUCTION of the centrifugally cast T56 turbine case, top, in 310 stainless might be gained by investment casting. Large columnar grains in certain sections can be seen in macro etched section (below).



5. IMPROVED ALLOY UTILIZATION has been gained by investment casting this burner support. A 15-lb. casting has replaced an 80-lb. forging.



6. THE TREND toward longer, thinner buckets is illustrated by dotted line, superimposed on photo of a t,pical shrouded bucket now in production.

Investment Castings Fit In...

able alloys exhibit a much lower strength level. This seems to be entirely logical if one considers that the higher the hot strength, the more difficult is the material to forge.

Under good foundry control with the proper inspection practices, it has been demonstrated that high quality standards are being maintained under conditions of high yield levels. Good foundry practice in handling such materials has primarily resolved itself into a logical approach in suitable gating and risering practice.

The productive capacity and ability of the investment foundry to achieve rapid expansion in times of emergency are of course an accepted and recognized advantage, demonstrated on more than one occasion when new tooling and rapid delivery of newly designed prototype parts have been required to meet rigid schedules.

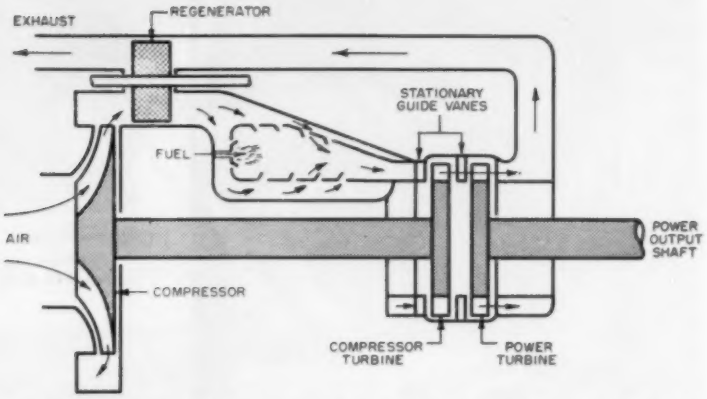
Parts such as segments for the variable nozzle of the afterburner and the core or body of variable entrance guide vanes are produced from Type 310 steel. These are complicated configurations

Continued on page 64

MATERIAL presented here was contained in a paper given by Dean K. Hanick, metallurgist with Allison Div., General Motors Corp., before the Fall meeting of the Investment Casting Institute.

1955 **Standard method of producing many components of today's aircraft turbine engines is the investment casting process.**

1965 **Ten years from now, passenger cars may be using investment cast parts by the millions in gas turbines...**



AIR PATH of the regenerative turbine is through the compressor, then through the regenerator where exhaust heat is added, and into the burner. The air, then 1500 F, enters the turbines that drive the compressor and power shaft, and finally into the regenerator.

You May Not Find Any Pistons In Your 1956 Ford...

"We in gas turbine engineering have a firm conviction that the numerous problems of design, performance and cost of turbos for vehicles will be solved. From a technical standpoint, the gas turbine today can be justified in heavy vehicles and a substantial number of passenger vehicles will be equipped with turbos within the next 10-year period . . . We believe that if a complicated device such as the internal combustion engine can be built as cheaply as it is, then the future gas turbine, by reason of its basic simplicity and potential high production will be produced at lower cost . . ." A. A. Kucher, Director of Scientific Laboratory, Engineering Staff, Ford Motor Co.

Here is a report by the associate director of Ford's Scientific Laboratory, delivered before the Fall meeting of the Investment Casting Institute, outlining the progress being made in selecting the materials and casting methods that will be used in tomorrow's automotive gas turbines . . .

THE automotive gas turbine, still in its early stages of development, will undoubtedly use a number of cast components. How many of these will be investment cast is a question which, according to Dr. Donald N. Frey who is working on the development of gas turbine power units for Ford Motor Company, can be determined largely by the ability of the investment casters to meet automotive cost limits on a production basis.

Dr. Frey pointed out the present use of investment castings for a large number of nozzle vanes, turbine blades for the compressor turbine wheels and suggested other possible applications for this casting method. He also indicated places permanent mold and shell mold castings are or might be applied successfully.

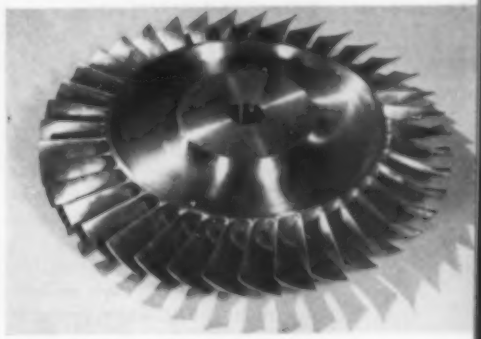
Here is Dr. Frey's explanation of the operation of the regenerative gas turbine in which investment cast parts may one day play an important part:

The air path of the regenerative turbine is through the compressor, then through the regenerator where exhaust heat is added, and into the burner where essentially constant pressure burning and secondary dilution occurs. Next, the air, now at approximately 1500 F, enters the turbine which drives the compressor, then into the power turbine where the useful shaft power is extracted, and finally through the regenerator where much of the remaining heat is returned to the incoming air.

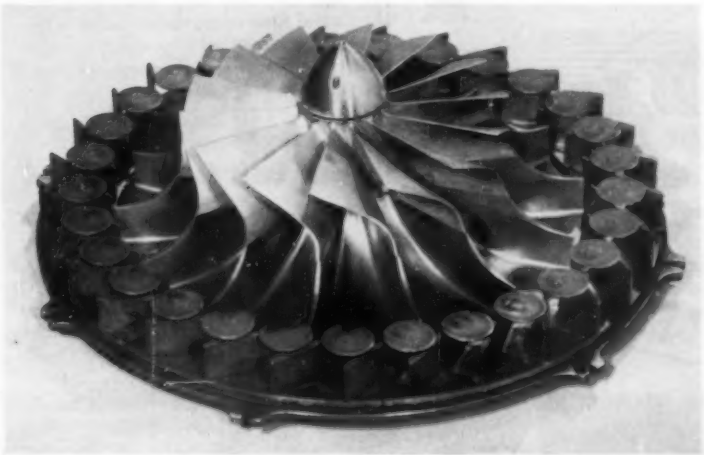
It is the regenerator, he commented, that makes the gas turbine as good as or better than the

BEARING CASING, the darker component, is now a nodular iron casting . . . may lend itself to a precision casting technique such as shell molding.

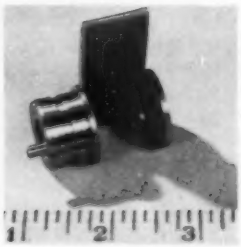
THE COMPRESSOR, about 9" in diameter, has two-piece construction, with the inducer an aluminum permanent mold casting and the expeller a forging.



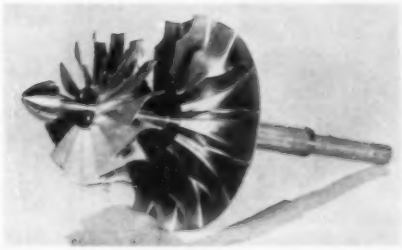
AXIAL POWER TURBINE, about 8" in diameter, indicates big potential use for investment cast blading. Use of cast blading appears attractive if costs can be held down.



COMPRESSOR TURBINE and variable area nozzle assembly, all mounted in the bearing case. Nozzles are movable to improve part load fuel economy of the engine.



SINGLE NOZZLE (left) from nozzle assembly is now being produced as an investment casting.



RADIAL INFLOW TURBINE (right) is two-piece construction: the exducer to be cast, the expeller forged and machined. Eventually, the expeller may be cast either as a separate piece, or integral with the exducer.

automotive piston engine by improving the part load fuel economy.

One of the principal problems faced by the designer, Dr. Frey said, is to keep the bulk of the automotive turbine engine down. The turbine weighs less than its piston engine competitor, but will, if care is not taken, take up more space.

Some of the present or prospective castings which may ultimately become regular performers in the gas turbine of the future were described by Dr. Frey.

The *compressor*, made of aluminum alloys for the pressure ratios and resulting discharge temperatures of interest will most likely be of two-piece construction, he commented. This two-piece construction is illustrated with the inducer being a permanent mold casting and the expeller a forging.

The physical properties of a permanent mold cast aluminum inducer, with the possible exception of fatigue properties, are adequate for the stress encountered. No success in casting in aluminum the impeller with the physical properties required has been achieved. Thus the forging method of fabrication is proposed. Surprisingly enough, Dr. Frey told Institute members, certain cast magnesium alloys have been tried in the impeller and were found to have more than adequate physical properties. Burst speeds in excess of 2,000 ft/sec have been obtained. I believe this superiority of cast magnesium over cast aluminum is due to the better ductility of the cast magnesium alloys.

Continued next page

The restriction in the use of magnesium in this part is the danger of fire. If a rub were to occur, this would produce heat and fine magnesium powder. It would appear that the final resolution of this difficulty will be in extensive field service testing.

For the two-piece construction of a *radial inflow turbine*, several fabrication possibilities present themselves he said. The exducer is clearly to be cast in any case and cast exducers of the type illustrated have performed satisfactorily so far. Stresses, of course, are relatively low in this part of the turbine. The expeller at this stage of development must be a forged and machined component, but he expressed hope that a cast expeller, either as a separate piece or integral with the exducer might eventually be developed.

The expellers used today are true investment castings. Their cost, according to the Ford scientist, appears too high by at least a factor of three and it further appears that the cost of the casting process itself must be reduced significantaly. He urged development of low cost investments and eliminatioin of wax or plastic patterns.

In many engine designs, an *axial flow turbine* would be used for the *compressor turbine* as well as for the *power turbine* stage. The use of casting techniques for making axial flow compressor turbine blading appears workable and even mandatory and an all cast power turbine stage seems feasible, Dr. Frey said, but an all cast axial flow compressor turbine appears marginal at present because of the most severe stress and temperature condition.

Cast Blades For Axial Wheels

Possible directions to go in making axial flow wheels were described. For most methods, casting of individual blades is necessary. The use of cast blades appears very attractive in the automotive turbine blade, he said, although the present day investment casting costs of such blades are too high. He indicated that a reasonable standard for the long run would be a maximum casting cost of 15 cents above metal per cast blade.

There are many ways to attach blades. The most direct and widely used today is to machine the root and fit it into a machined or forged slot on a forged rotor. This he called prohibitive in cost for automotive turbine use. Cast blades will have to be attached to the rotor by welding or brazing or by a second casting process whereby the rotor is cast onto the assembled blades. This latter all-cast process looks feasible for power turbine stages.

The prospect of a turbine wheel cast in one piece in one operation does not appear promising at the moment, Dr. Frey said, but it cannot be neglected. If casting quality or scrappage rates with such a process could be reduced, this could be the ultimate answer for at least power turbine staging.

The *nozzle vane*, at the present time, is an investment casting, but

Continued on page 79

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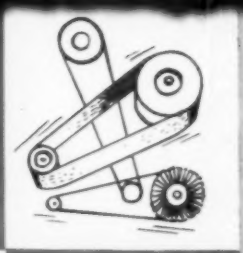
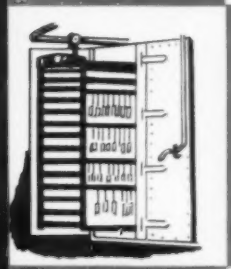

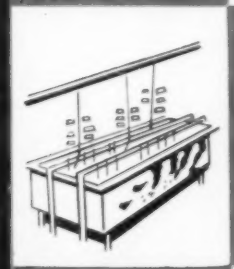

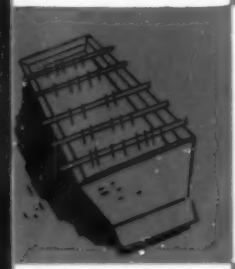

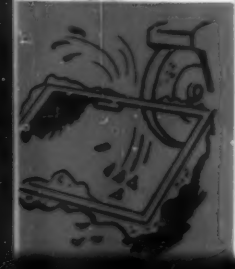

PMM

Finishing Section

Finishing includes all secondary operations performed on precision metal molded parts — up to and including final surface treatment. This section presents new information about the specialized methods, equipment and materials needed for finish-machining, assembly, surface preparation and final finishing of all precision metal molded parts.

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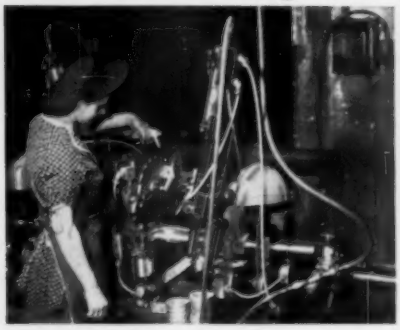
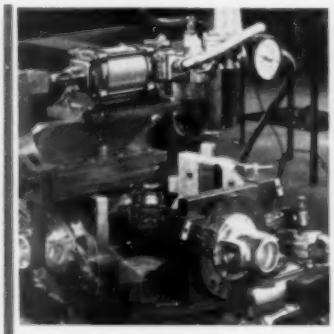


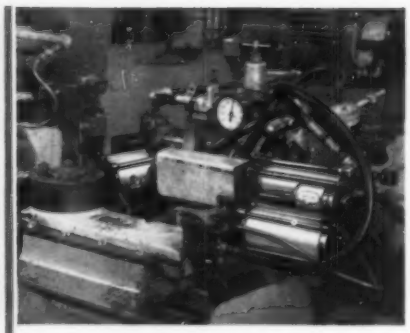
THREE PIECES FOR THE COST OF ONE

This special machine drills two die castings for vacuum cleaners at one time. Eight holes are drilled in one, thirteen in the other. Two Bellows Air Motors and two Drill Press Feeds do all the work — the operator only loads and unloads work pieces.



FINISHING OPERATIONS DONE 2½ TIMES FASTER

Two Bellows Air Motors and a Rotary Feed Table made the difference. This shop-built machine drills, bores, and faces aluminum gas regulator bodies.



DIRECT COSTS CUT FROM 17.4c TO 14.3c

Two Bellows Air Motors were installed on this turret lathe to control cross-slide and turret actions. Inside and outside diameters are finished and threads rolled on die cast temperature regulator parts.

Here are three actual cases of large cost reductions made in die castings. In each case savings have been made by using one or more Bellows Air Motors . . . to replace slow, manual methods, or to combine separate, related operations into one efficient, economical process.

Such conversions are inexpensive and amazingly easy. For the Bellows Air Motor is a unique and different air cylinder. It is a power unit complete in itself — with all controls built-in. Advance and retract speeds are independently adjustable. Built-in 4-way valves, in a wide choice of electrical, pneumatic, or manual controls, provide the type of control needed for each job. Only one air connection is required, and that can be made with flexible hose. Bellows Air Motors are easily interlocked for automatic sequencing of work movements.

With these facts in mind, take a new look at your own shop. Wherever you see an operator's hand or foot moving a crank, wheel, lever, or pedal back and forth . . . back and forth, you see a high-cost operation. In nine out of ten such cases a Bellows Air Motor can do the job faster, better and far cheaper.

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Abrasive Rolls... new tools for metal finishing

By JAMES L. ERICKSON
Chairman
American Abrasive Products, Inc.

EXPENDABLE rolls of coated abrasive cloth are finding wide usage in tool and die shops, as well as on the finishing line where precision metal castings are processed.

ABRASIVE rolls, made from coated abrasive cloth, are comparatively new tools for finishing metal parts. They are today proving to be versatile, expendable tools in the die and mold making shops, repair shops and finishing departments of die casters, permanent mold casters, investment casters, and powdered metal parts fabricators.

What Is An Abrasive Roll

An abrasive roll is nothing more than a tool of an expendable nature used to abrade a softer material than itself for the purpose of cleaning, grinding, and/or polishing a surface.

The abrasive roll, Figure 1, consists of a continuous coil of coated abrasive strip wound and glued tightly together in the form of a roll, much like a rug that has been rolled up for transit.

In use, the abrasive roll is mounted on a mandrel, Figure 2, that slips up into its center hole, left for this purpose in the preparation of the roll; the mandrel is then revolved at a speed ranging from 1,000 to 35,000 rpm. Next, the revolving roll is pressed against the surface to be cut, or literally worn away, by the tiny particles of aluminum oxide (or silicon carbide) imbedded in the surface of the coated abrasive material.

As the cutting action proceeds, the roll itself gradually wears away, at the same time it is having a substantial cutting effect on the surface being worked. This wearing away of the roll proceeds by the successive disintegration of the closely rolled layers of coated abrasive cloth: first the particles, then the cloth itself, then the next layer of particles, then the cloth holding these, and so on.

The mandrel, Figure 2, is revolved by a suitable power unit such as a rotary air grinder, electric grinder, etc.

The following factors influence the degree of abrasion:

1. The hardness of the abrasive particles imbedded in the abrasive cloth used to make the rolls;
2. The size and shape of the abrasive particles;
3. Their distribution and abundance;
4. The degree to which they are bonded to the surface of the abrasive cloth;
5. The force with which they are placed in contact with the surface to be abraded (a force which in turn is a function of the diameter of the roll, the roll's rpm and the magnitude of the force used to press the roll against the surface to be abraded); and
6. The nature of the surface to be abraded, i.e. its hardness, degree of smoothness, melting point, etc.

Unfortunately, no one has worked out a mathematical formula suitable for shop use that

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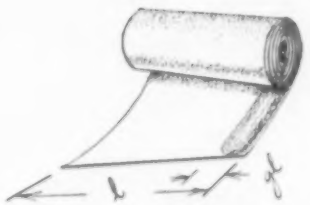
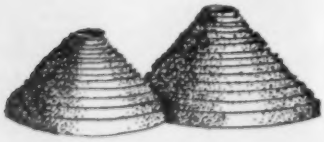


1. PARTIALLY ROLLED cartridge shows glue layer (gl) that holds the roll together.

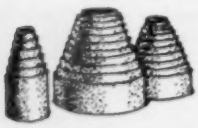
2. CARTRIDGE ROLL (B) is pressed onto mandrel (A) in the direction (F) and rotated at high speeds.

THREE BASIC FORMS OF ABRASIVE ROLLS

3. FOUR SIZES of cartridge type abrasive rolls indicate the range of usefulness and adaptability.



4. FULL TAPER spiral type abrasive rolls can be obtained in heights up to 1½ inches.



5. SIDEWALL TAPER is a variant on the spiral type roll which provides side and angular abrasive surfaces.

enables one to calculate the optimum grit size, roll shape, rpm, applied force, etc., given the physical properties and mechanical characteristics of a surface to be abraded and the end results desired.

Sizes and Types of Abrasive Rolls

There are two major types of abrasive rolls: (1) *the cartridge* sometimes referred to as "pencil" type rolls in the smaller diameters, Figure 3, and (2) *the spiral*, Figures 4 and 5. The cartridge type have the same outside diameter over the entire length, while the spiral rolls are tapered in diameter.

Spiral rolls are subdivided into two classes: (1) the *full taper* type, see Figure 4, and (2) the *side wall* type, Figure 5. In the case of the full taper, the outside diameter begins to decrease beginning at the base end, while the outside diameter of the side wall type does not begin to decrease until ¼ to ¾ of the distance between the ends of the roll —leaving the remaining length of the roll of uniform diameter.

Table 1 lists the most common sizes of the different classes of abrasive rolls. An examination of this table shows that the smallest cartridge type abrasive roll in common use is ¼" OD x ¾" face x ⅛" hole size, while the largest is 1½" OD x 2" face x ¼" hole size. Rolls both larger and smaller than these extreme sizes are made, but generally on special order only.

It is interesting at this point to note that the thickness of the abrasive cloth used to make rolls varies with the size of the grit particles on its surface. The larger the grit particles (and the smaller the grit number) the thicker the abrasive cloth. It follows that if one wants to make a series of rolls of a given diameter, say 2", it takes a longer piece of abrasive cloth of large grit number to make such a roll than it does of a small grit number. In other words, more raw material (in this case, abrasive cloth) is used to make a given roll out of a large grit number than out of a smaller grit number (by length.) Since the cost of the raw material is predicated on the cost of this material per foot, the cost of abrasive rolls of a given diameter is a function of the grit number.

Abrasive rolls fit easily onto mandrels with the base end of the roll butting against a threaded spiral tapered position on the mandrel. This portion is short in length, while the remaining end of the mandrel fits into the chuck of an air or electric motor-driven

Continued on page 64

TABLE 1. SIZE RANGE OF ABRASIVE ROLLS

Cartridge Rolls

Outside Diameter	Length or Face	Outside Diameter	Length or Face
1/8	3/4"	1/4"	1½"
5/16"	3/4"	5/16"	1½"
3/8"	3/4"	3/8"	1½"
1/2"	3/4"	1/2"	1½"
5/8"	3/4"	5/8"	1½"
3/4"	3/4"	3/4"	1½"
1"	3/4"	1"	1½"
1⅛"	3/4"	1⅛"	1½"
1¼"	3/4"	1¼"	1½"
1⅜"	3/4"	1⅜"	1½"
1½"	3/4"	1½"	1½"
1/4"	1"	1/4"	2"
5/16"	1"	5/16"	2"
3/8"	1"	3/8"	2"
1/2"	1"	1/2"	2"
5/8"	1"	5/8"	2"
3/4"	1"	3/4"	2"
1"	1"	1"	2"
1⅛"	1"	1⅛"	2"
1¼"	1"	1¼"	2"
1⅜"	1"	1⅜"	2"
1½"	1"	1½"	2"

Spiral Rolls: Full Taper

Base Diameter	Overall Height	Base Diameter	Overall Height
3/8"	1"	1/2"	1½"
1/2"	1"	5/8"	1½"
5/8"	1"	3/4"	1½"
3/4"	1"	7/8"	1½"
7/8"	1"	1"	1½"
1"	1"		

Spiral Rolls: Sidewall Type

Base Diameter	Overall Height	Sidewall Height	Base Diameter	Overall Height	Sidewall Height
1/2"	1"	3/4"	1"	2¼"	1¼"
1/2"	1¼"	1"	1"	2½"	1½"
1/2"	1½"	1¼"	3/4"	1"	3/4"
1/2"	1¾"	1½"	3/4"	1¼"	1"
1/2"	2"	1¾"	3/4"	1½"	1¼"
1/2"	2¼"	2"	3/4"	1¾"	1½"
1/2"	2½"	2¼"	3/4"	2"	1¾"
3/4"	1"	1/2"	3/4"	2¼"	2"
3/4"	1¼"	3/4"	3/4"	2½"	2¼"
3/4"	1½"	1"	1"	3/4"	1/4"
3/4"	1¾"	1¼"	1"	1"	1/2"
3/4"	2"	1½"	1"	1¼"	3/4"
3/4"	2¼"	1¾"	1"	1½"	1"
3/4"	2½"	2"	1"	1¾"	1¼"
1"	1¼"	1/4"	1"	2"	1½"
1"	1½"	1/2"	1"	2¼"	1¾"
1"	1¾"	3/4"	1"	2½"	2"
1"	2"	1"			

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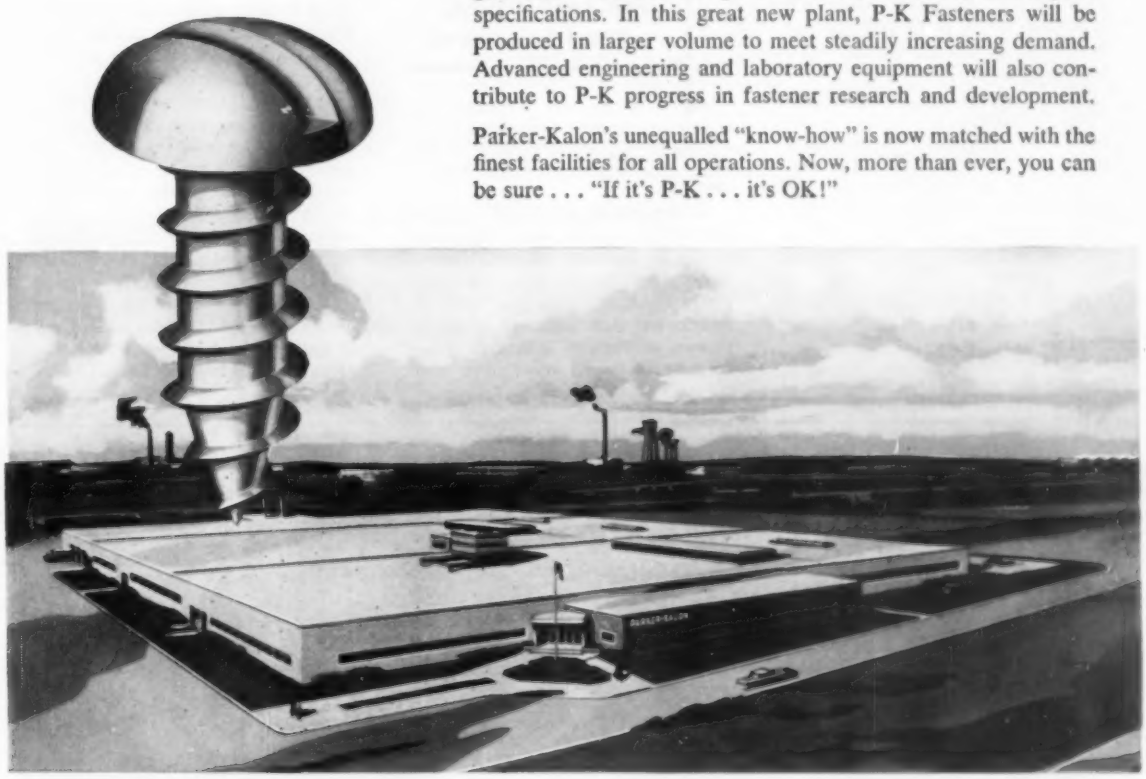

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tool which revolves the mandrel at high speed. If pressure is applied to the roll, the mandrel tends to screw itself up into the inside diameter of the roll—which in turn, prevents the roll from slipping.

To highly polish a die casting die cavity that has deep tool marks, begin by using, say, a roll of 80 grit material, and subsequently 120, then 180, then 220 grit, and so on until the desired degree of polish on the die surface is obtained.

Abrasive rolls are cheap to use. Their initial cost is very low compared for example to mounted stone points, and their final cost is also low because they are not subject to the breakage characteristic of ceramic type cutting wheels and most mounted hard stone points.

Even though they are expendable, they do last a relatively long time in use.

They are safe to use because they do not break into dangerous little pieces that fly up.

They are flexible, and consequently, tend to assume the shape of the surface they contact when revolving, thus uniformly cutting the surface. In addition, they wear away evenly and not in one or two spots on their surface—characteristic of hard wheels.

FORM CONVAC DIVISION

Consolidated Vacuum Corp., wholly owned subsidiary of Consolidated Engineering Corp., has been merged with the parent organization and will be known as the ConVac Division of Consolidated, according to an announcement by Philip S. Fogg, president of the Pasadena firm.

No change in the policies, management, or personnel will occur.

AIRCRAFT TURBINES

continued from page 55

which in the present state of the art lend themselves to investment castings.

However, development work in precision forging and improvements in brazing with high temperature materials has been seriously considered on the variable nozzle exhaust segment which is shown in Figure 3. A two piece forging followed by nickel base alloy brazing appears to be an attractive method of manufacturing because of possible cost savings and quality improvement.

It is recognized that the experimental gating and risering techniques in the foundry were never successful in completely eliminating the shrinks in this casting although the holes were chased to a non critical area of the part. This particular detail is specifically mentioned because it is a good example of occasional foundry performance which may adversely influence the engineer in choice of casting or forging on some fu-

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ture design.

For applications of this type which specify Type 310 steel, either the cast or forged shape has adequate durability in consideration of physical properties and alternate manufacturing procedures then become an excellent approach to stimulating technical development for the improvement of both quality and cost.

The T56 turbine case which is shown in the photograph, Figure 4, is another example of a part which can be produced either by casting or forging, currently used as a centrifugal casting. It is suggested that here is a challenge to the investment casting industry to further improve alloy utilization for which reason it is cast instead of forged. For example, when a similar experimental part was fabricated from a forging, the weight was approximately 240 pounds. Casting reduced the weight to 138 pounds after rough machining at the foundry.

This apparently would indicate an improved utilization of alloy but the resulting machining chips although they stay at the foundry for return scrap melting is not the answer. It is conceivable that this part if precision cast would weigh only 108 pounds after removal of gates, sprues and risers.

From the standpoint of durability of this component there seems to be no criticality with respect to the typical large and columnar grain structure as illustrated in the macro etched cross-section of Figure 4. However, some improvement in grain structure might be accomplished using hot investment molds to produce more equiaxed grains.

The burner support in Figure 5 is another example of improved alloy utilization by reducing weight from an 80 pound forged plate down to a 15 pound casting. This again reflects in cost.

Future Applications

It has become apparent that some of the advance designs on turbine buckets are tending to make it more difficult to produce investment castings because design trends for obtaining performance include not only shrouded configurations but long, thin airfoil sections. The problem of adequate gating and feeding coupled with the problem of hot tears in the mold necessarily complicate the casting procedures.

In this respect, a cast shape of preferred geometry followed by hot forging or coining many be the attractive manufacturing procedure. This would then tie together both foundry and forge shop with justification of the process on the basis of alloy utilization and cost. A further benefit may be incurred on some configurations with only slight compromize on strength from the casting since the blade interior near the root would receive little or no hot work.

The photograph of a typical shrouded production bucket is compared in Figure 6 with a line drawing of an advance design for convenience in comparing size. Casting turbine blades of this type will call for a considerable amount of ingenuity on the part of the foundryman. Selection of alloy for castability without sacrifice of required hot strength will play an important role in maintaining the productive position occupied by the investment casting industry.

Other applications which could have great impact on the investment casting industry are the results of future requirements for much larger compressor cases made from both stainless and non stainless ferrous base materials. Certainly, we should not overlook the possibility of replacing magnesium at little or no weight sacrifice with ductile type of cast iron having properties which should demonstrate utility in such applications. In this connection recent protective coating developments for corrosion resistance on non stainless materials will extend investment casting usage and benefit from the high potential productivity and cost reduction.

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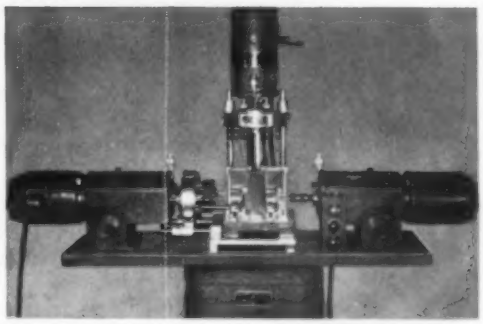

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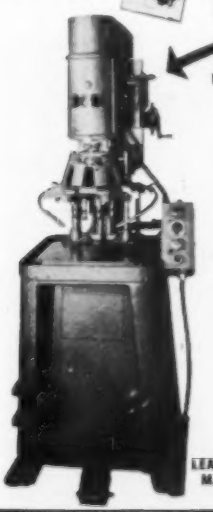

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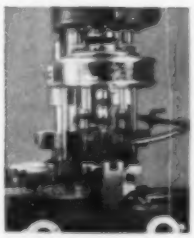

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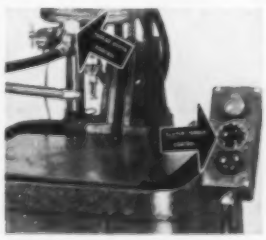

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CHECK LIST OF PROTECTIVE NEEDS

- ☐ Will a coating of paint be applied, or will the protective coating be the "final" treatment?
- ☐ What type of atmospheric exposure can be expected in service? Indoor, normal outdoor, industrial or sea air?
- ☐ How much equipment will be required, how complicated and how expensive? How much floor space will be required?
- ☐ Can the coating be applied at room temperature or does it require heating or electrolytic equipment?
- ☐ What requirements do the sales factors impose? Appearance can range from simply "acceptable surface" to a finish which helps sell merchandise.
- ☐ Are there special performance conditions such as light absorption, electrical conductivity, resistance to abrasion, etc.?
- ☐ What base metal and, in some cases, which alloy are used for castings?
- ☐ How critical is the maintenance of the solution used in coating?

CHEMICAL OXIDE

A working guide to selecting and applying

Surface Protection for Die Castings

WHILE die cast surfaces in untreated condition have adequate resistance to corrosion for many applications, a number of important uses of die castings introduce conditions of exposure which require further surface protection.

Part of the tremendous expansion in the use of die cast components is due to the successful development of specialized chemical and electrolytic treatments which passivate, seal and insulate the die cast metals against surface corrosion.

Some of these finishing systems have also helped to widen the use of organic coatings on die castings by providing a superior bond between the paint and the base metal. And beyond their protective qualities, certain of these coatings also have or can be given decorative appeal.

The problem is: which one should you choose to protect die cast surfaces against various types of exposure, while at the same time, considering ease of application.

The range of use for electroplated coatings is fairly well established, being specified principally for appearance, rather than for the protection they afford. Likewise, the application of organic coatings has been determined on the basis of styling ... where extra protection is required, some form of preliminary chemical or electrolytic surface treatment is indicated.

Whether or not your castings are going to get a decorative organic coating, you will probably want to consider the use of a protective finish directly on the die cast metal. Fortunately, there is a variety of surface protective coatings to choose from, most of which are offered in proprietary form with accurately controlled composition and dependable performance. For each of these, exact techniques of application have been developed to gain maximum protection. Also, some processes are offered under a licensing arrangement.

Factors to consider

If your castings are going into some piece of military equipment, you'll have small problem deciding which surface treatment to use; the military specs will tell you what performance is required. But in consumer products, it will be up to you to decide whether any sort of extra protection is needed and, if so, which one.

To some engineers, it appears that one type of coating is about the same as another, the main difference being cost. However, there are a number of points to consider before you get down to the hard computation of cost per square foot of surface.

First, the surface treatment must be compatible with the basis metal. Whether you are using zinc, aluminum or magnesium die castings will be the first item that will help you in making a determination. It may even be necessary to know which alloy of the metal.

Next to be considered is, "Will a coat of paint be applied over the chemical or electrolytic surface treatment, or is this the final surface?"

What type of exposure will these surfaces be required to withstand, and for how long? A type of protective treatment that is adequate for prolonged exposure to normal outdoor weathering may not hold up in sulphurous industrial fumes or salt laden sea air.

From the production point of view, you will want to consider whether or not this type of coating calls for elaborate, new installations in your plant, or whether some simple and inexpensive unit that doesn't require much floor space can be used.

In the same direction, it may be important to find out whether the finish can be applied from a room temperature solution, whether heat must be applied, or perhaps more expensive electrolytic apparatus is needed.

Continued next page

	EXPOSURE*					SUITABLE FOR** DECORATIVE FINISH	PAINT BASE	
	INDOOR	NORMAL OUTDOOR	INDUSTRIAL	SALT HUMID	WATER CONTACT		AIR-DRY	BAKED
ZINC CHROMATE	●	●	●	●	Occas.	● (Black or Dyed Color)	●	●
PHOSPHATE	●	AS PAINT BASE ONLY			Occas.		●	●
ANODIZED	●	●	●	●	Occas.	● (Clear)	●	●
BLACK MOLYBDATE	●					● (Black)	●	
BLACK CHROMATE	●	●	●	●	Occas.	●	●	●
ALUMINUM CHROMATE	●	●	●	●	●	● (Clear or Dyed in Colors)	●	●
PHOSPHATE	●	AS PAINT BASE ONLY			●		●	●
ANODIZED	●	●	●	●	●	● (Dark Colors or Black)	●	●
CHEMICAL OXIDE	●	●	SEAL WITH HOT DICHROMATE				●	●
OXIDE-CHROMATE	●	●	●	●	●		●	●
MAGNESIUM CHROME PICKLE	●	●	DICHROMATE SEALING IMPROVES CORROSION RESISTANCE				●	●
CHROME ALUM	●	●				● (Black)	●	
CHROMATE	●	●	●	WITH PAINT	Occas.		●	●
ANODIZED	●	●	●	●	Occas.		If Modified by Acid Treatment	
HYDROFLUORIC DICHROMATE	●	●	●	●	Occas.		●	●

SURFACE PROTECTION (continued)

The sales department should not be overlooked, either, for a gadget that goes inside a working mechanism may be entirely satisfactory with an olive drab colored coating that gives good protection, whereas an item that is to be displayed on the shelf of a hardware store may rule out anything but a clear, bright lustre, even though it gives no better protection than the darker colored coating.

Additional service conditions may also influence your decision. For example, where abrasion is a condition of operation, then a hard, dense coating must be specified. If some liquid, such as water, alkalies or other material is occasionally in direct contact with the surface, this should also be noted. In special equipment, such as optical and photographic goods, perhaps the most important condition after surface protection will be the need for a non-reflecting surface film. On the other hand, electrical insulation or conductivity may be desired from the film which is, primarily, chosen for its ability to protect metal.

After balancing out these properties, it might be a good idea to check on the type of products now receiving these coatings. If, for example, you find that the finishing system you are considering is being used on business machine housings, then you'll feel safe in specifying the same material for less vigorous service in decorative escutcheons. If it is being used successfully to protect the metal parts of traffic signals, then it will probably do equally well on parking meters.

What types of coatings are available?

Protective coatings may be grouped into generic types such as phosphate, chromate, anodic, chemical oxide, chrome pickle, etc. Some of these may be used for more than one type of base metal; others are sharply restricted in application.

Here is a thumb-nail outline of the general types of coatings commonly in use on die castings, together

APPLICATION***								REMARKS
ROOM TEMP BATH	HEATED BATH	ELECTROLYTIC BATH	DIP	SPRAY	BRUSH	MANUAL	AUTOM	
●	●		●	●	●	●	●	Leaching removes slight iridescence, gives clear white finish.
	●		●	●		●	●	
		●	●			●	●	
	●			●		●	●	Lowers light reflectivity, resists fingerprint corrosion.
●	●		●	●		●	●	
	●		●			●	●	
	●		●	●		●		
		●	●				●	Very abrasion resistant — oxide coating.
	●		●					Less abrasion resistant than anodic coating.
Dip and Brush	Spray		●	●	●	●	●	Electrical conductor; can be arc or spot welded.
	●		●			●		Protection during process, storage & shipment.
	●		●					Less protective.
●			●			●	●	Low electrical resistance.
		●	●			●	●	Abrasion resistant.
	●		●			●		Satisfactory paint base for all exposures.

with descriptions of some principal properties.

Chromate conversion coatings can be used on zinc, aluminum and magnesium die castings, although different formulations are required for each. The film is produced by immersion in a dichromate bath. The film usually has a yellowish iridescence, although leaching out this color with a mild alkaline solution results in a bright, clear, bluish-white finish similar in appearance to chromium plating.

Chromate coatings are suitable as final finishes or as a base for paint. Where added abrasion resistance is needed, a clear lacquer may be applied over it. As a preliminary step before plating, the chromate film can be stripped, living a bright, chemically polished surface on the base metal.

Chromate films are available in different formulations for the two main zinc die casting alloys, and other compositions can also be obtained to give protection to aluminum and magnesium die castings.

Phosphate coatings consist of a dense layer of nonmetallic phosphate crystals bonded to the metal surface, providing a "blanket" that insulates the base metal against electrochemical corrosion. At the same time, they offer a mechanical bond to help with paint adhesion.

These coatings can be used on zinc or aluminum, as well as steel, and certain of them can be applied to all three metals processed simultaneously on the same production line.

Phosphate coatings are generally used as preparatory treatments before painting, seldom as finish coatings themselves.

Anodic coatings can be developed on zinc, aluminum or magnesium, although this type of electrolytically formed surface film is best known as an aluminum treatment. A proprietary process for obtaining either yellow or black anodic coatings on zinc was also developed during World War II to protect zinc plated steel, although it is equally suitable for use on zinc castings. These consist principally of zinc oxide and zinc chromate, with the black anodic coating including also basic chromic chromate.

Anodized aluminum is an exceptionally hard, refractory coating of aluminum oxide. While aluminum, exposed to the air, forms a natural oxide coating, the electrolytic process in any of several varied techniques produces a heavier, more uniform coating. This coating is non conducting and is extremely resistant to abrasion.

On die cast magnesium, an anodic finish having good abrasion and corrosion resisting properties can be obtained using a sodium hydroxide solution. The anodized surface is then sealed with sodium chromate.

Black coatings for a combination of protection with a non-reflective surface are useful in many instances. Aside from the appeal of a smooth black surface as a decorative coating, this type of finish has specialized uses, such as interior of optical and photographic instruments, lighting devices, etc.

Black molybdates and chromates are commonly used (in addition to the anodic treatment mentioned above) on zinc die castings to obtain black coatings. The molybdates have limited use, not being recommended for outdoor exposures, while the chromate black has the same service characteristics as reported for the regular dip chromates.

Black nickel is sometimes applied, but since this is an electroplating process, is not included in this report.

On aluminum, anodic coatings can be dyed black, although special techniques must be used when dealing with the common high silicon die casting alloys. The silicon tends to produce an uneven, streaked or smutty finish, although methods have been developed for avoiding this condition.

Oxide-chromate coatings can be produced from proprietary solutions giving a thin iridescent golden brown coating on aluminum. This is an amorphous coating, integral with the metal surface. Properties are reported to include electrical conductivity, permitting arc welding and spot welding. It is used for both corrosion resistance and paint base.

Chrome pickle is a treatment developed specifically for protecting magnesium and is satisfactory for protection during storage and shipment, while also providing a satisfactory base for paint. To increase the efficacy of this treatment for more severe exposure, the coating can be sealed in a boiling dichromate bath. Slight etch provided by the chrome pickle aids the development of paint bond. Since this process removes as much as .002 from the metal surface, it is not used where close tolerances are necessary.

Hydrofluoric dichromate treatment, also developed for use on magnesium, gives better protection against corrosion than the chrome pickle and does not remove metal. Characteristic color of the coating is a brown or black. This method can be used either as a final finish or as a paint base for all conditions of exposure.

Other treatments are available for the die cast alloys, but are not as commonly used. Some are variations on the above general types of surface coatings. Detailed technical information about most of the processes mentioned above is available, including process methods, salt spray resistance, and physical properties.

CREDIT IS DUE: The editors of PMM wish to thank the following companies who have contributed information—Allied Research Products, Inc., The Chemical Corp., Enthone, Inc., Heatbath Corp., Neilson Chemical Co., Northwest Chemical Co., Oakite Products, Inc., Parker Rust Proof Co., and United Chromium Div. of Metal & Thermit Corp.

How are they applied?

Typical process cycles should be of interest as an indication of the manner in which each type of finishing treatment will fit into an existing production line. While manufacturers of proprietary finishing materials differ somewhat in the recommended cycles for their materials, typical processes are described here which, in general, indicate minimum and maximum operating conditions.

A chromate coating cycle recommended by one manufacturer is as follows: 1) Clean with an alkaline cleaner; 2) Cold or warm water rinse; 3) Neutralize in a 1 to 3% sulphuric or ½ to 1% nitric acid bath at room temperature for 15 to 30 seconds; 4) Cold running rinse; 5) Dip-agitate in a bath made up of a 1:1 mixture of water and proprietary solution for 10-45 seconds at 130 to 150F; 6) Cold water running rinse; 7) Where clear, bright finish is desired, leach in a 3 oz./gal caustic soda bath for 5 to 15 seconds; 8) Rinse in cold running water; 9) Rinse in clear hot water not to exceed 160F; 10) Dry by air blast or centrifuge not to exceed 160F.

For the above cycle, tanks, racks and coatings should be made of the following materials: Types 304 or 316 stainless steel welded with 310 Mo electrodes, Koroseal, Tygon or polyethylene.

Phosphate coating cycles have been suggested by one manufacturer as follows. Since these coatings can be applied by spray, immersion or brush on, several alternatives are available.

Either a three-stage or five-stage cycle is suggested for spraying or immersion. The three-stage spray washer cycle calls for spraying the proprietary solution for 1 minute at 140F, followed by a cold water spray rinse for 1 minute, and a mild chromic-phosphoric acid rinse for 30 seconds at 140F. Forced air or oven drying is recommended. To extend this to a five-stage cycle, the above steps are preceded by an alkali or emulsion cleaning for 1 minute, followed by a hot water spray rinse to remove alkali residue.

The immersion cycles are comparable, using similar baths. One manufacturer suggests that the tank treatment with agitated solution is superior for processing zinc die castings. On the other hand, several large spray installations have been noted in which zinc, and aluminum die castings and steel parts are processed simultaneously.

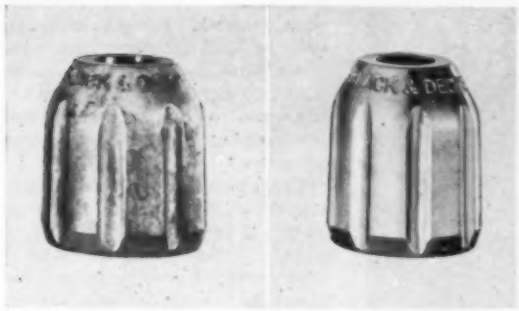
In the brush-on technique, the proprietary solution is reduced with two or three parts water, applied with suitable brush, then flushed off with hot water. A mild chromic-phosphoric acid rinse may then be wiped or brushed on.

Tanks for this process may be constructed of mild steel, and heating can be accomplished by any units capable of maintaining the solutions at specified operating temperatures. Some variations in the above cycle have been indicated with regard to temperatures, and length of immersion or spray, but the number of stages and flexibility are comparable.

Anodizing is a simple means of forming an oxide coating on aluminum electrolytically. A proprietary method for applying this for zinc is also commonly used.

After preparing the aluminum surface by polishing or other mechanical treatment, the casting is made the anode in a suitable electrolyte such as sulphuric acid (by a patented process), or chromic, oxalic, phosphoric, sulfamic or boric acid. For anodizing magnesium a 5 percent sodium hydroxide solution can be used. *Continued on Page* 64

Coatings Cover Broad Range Of Protection Needs

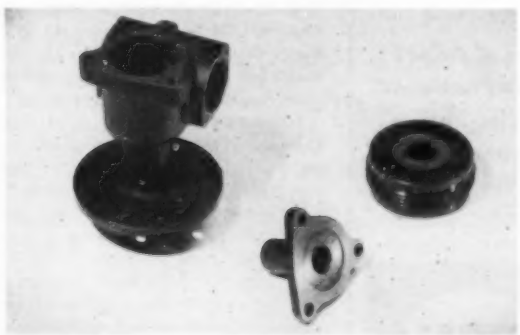


Allied Research Products, Inc.

CASE NO. 1: Protective coating (without paint) for zinc die castings used on a portable tool. Raw casting is at left, chromate coated casting at right. Treatment cycle is: 1) Anodic alkaline clean 30 sec.; 2) Cold water rinse; 3) Acid neutralize in 2% sulfuric acid; 4) Cold water rinse; 5) Iridite #4-73 at 140° for 30 sec.; 6) Cold water rinse; 7) Sodium carbonate bleach, 3 oz./gal. for 5 sec.; 8) Cold water rinse; 9) Hot water rinse; 10) Warm air dry.

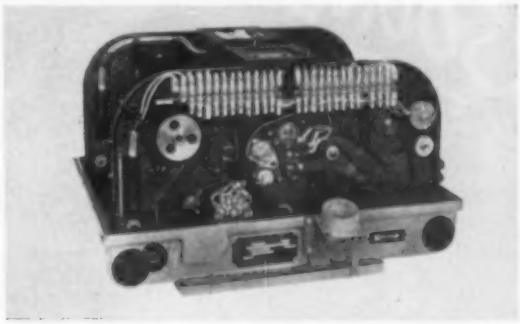
Parker Rust Proof Co.

CASE NO. 2: Protective coating prior to painting an aluminum die casting used in a household appliance. Phosphate coating is applied using 6 steps: 1) Parco cleaner; 2) Hot water rinse; 3) Bonderite by drip or spray; 4) Cold water rinse; 5) Parcolene rinse; 6) Oven dry.



Romec Pump Div., Lear, Inc.

CASE NO. 3: Black anodized coating for die cast aluminum jet engine components to meet government spec. Process cycle includes: 1) Alkali clean; 2) Cold water rinse; 3) Anodize in 15% sulfuric acid 30 min. by Alumilite procedures; 4) Cold water rinse; 5) Neutralize in sodium bicarbonate bath; 6) Cold water rinse; 7) Dye; 8) Cold water rinse; 9) Seal dye coat in potassium bichromate bath; 10) Cold then hot rinses.



Allied Research Products, Inc.

CASE NO. 4: Protective coating prior to painting Dow H magnesium casting used in aerial camera by Chicago Aerial Industries, Inc. Good conductivity of Iridite #15 Mag-Coat has functional use: coatings having lower conductivity would prevent adequate grounding of components and cause radio interference. Process cycle is: 1) Surface lapped; 2) Solvent wash; 3) Rinse; 4) Etch type cleaner NaOH 8 oz./gal at 160F for 10-20 min.; 5) Rinse; 6) Iridite #15 modified using ½ normal HCl to reduce dimensional change; 7) Rinse; 8) Hot rinse at 160F; 9) Dry.

Raytheon Mfg. Co.

CASE NO. 5: Protective coating prior to painting magnesium die casting. Process cycle for these Walkie-Talkie castings is: 1) Clean; 2) Dow #7 process with hydrofluoric acid solution for 5 min.; 3) Cold rinse; 4) Boil at least 45 min. in sodium dichromate bath; 5) Rinse in hot and cold running water. After drying, the castings get a zinc chromate primer, spray painting and baking.

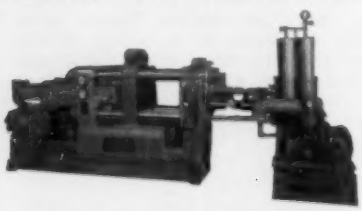
HOW TO GET SOUND DIE CASTINGS

NEW H-P-M Mechanical Clamp Assures Positive Die Locking

Here's why H-P-M's new die casting machine makes better castings: new positive clamping action is achieved by sliding wedges driven by knuckle-joint linkage which preloads the press frame and backs up the platen. The results . . . a minimum of flash . . . sound castings.

In this new H-P-M clamp mechanism there are no toggle pins under heavy shear load . . . no single line contacts . . . and no extremely high stressed members that normally result in high maintenance cost and down time.

These are just a few of the 40 new and improved features of the new H-P-M die casting machine. Write for Bulletin 5400, a completely illustrated story on this H-P-M line of profit makers.



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The properties of the oxide film will vary, depending upon the alloy, electrolyte, and length of cycle. Thus, in an aluminum alloy, silicon has a tendency to cause dark, uneven streaks and can only be used for decorative purposes when dyed black or a dark color; copper in an aluminum alloy tends to cause porosity and low resistance to corrosion and abrasion.

The typical sulfuric acid anodizing cycle includes the following steps: 1) preclean; 2) rinse thoroughly in hot water; 3) rinse in cold water; 4) anodize in tank for about 35 minutes while agitating; 5) rinse thoroughly in cold water; 6) where color is desired, immerse in dye bath for 15-30 minutes depending upon color; 7) rinse; 8) oven-dry at 180-190F for 15 minutes; 9) set dye in nickel acetate solution for 15-20 minutes; 10) rinse in hot water; 11) dry.

For anodizing zinc die castings, the cycle after cleaning, blasting, tumbling or other preliminaries,

Enthone, Inc.

JET BLACK coating over zinc is decorative and increases corrosion resistance. Coatings are 0.00004 to 0.00008 thick and resist normal handling and wear.

includes: 1) thorough rinse; 2) anodize; 3) water rinse; 4) hot water dry. Tanks and other equipment for anodizing are similar to that required for electroplating.

Chrome pickle is a relatively simple and rapid method of applying a utility coating on magnesium die castings, and it requires only a 10 second dip in a sodium dichromate or chromium trioxide and nitric acid bath, followed by 5 seconds air exposure, and cold and hot water rinses. To improve the corrosion resistance, the chrome pickle is then "sealed" by boiling for about 30 minutes in a dichromate bath.

to get any of the free materials described here, circle the appropriate number on the reader service cards bound into this issue

PRODUCT NEWS AND DEVELOPMENTS

MOLTEN METAL PUMP FOR DIE CASTING POTS

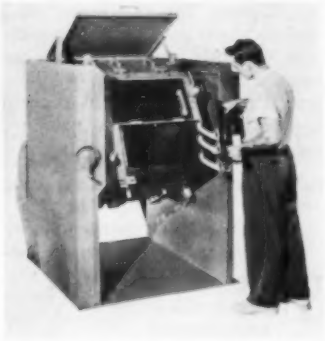
A new molten metal pump has been introduced that has been specifically designed for handling molten metal and molten salts such as are found in the die casting industry and in small heat-treating plants.

The pump is driven by a one horse-power motor and all submerged parts are fabricated from stainless steel to insure long life, particularly when handling molten zinc alloys.

The pump is designed to handle 45,000 pounds of molten zinc per hour with 80-90 psi air pressure at 30 cu. ft. per minute. The standard length of the unit is three ft. from base to the center line of the discharge. Other lengths can be supplied on order.

Wire Equipment Manufacturing Co., Inc.
For more information, circle No. 205 on the Reader Service Card

BARREL FINISHING MACHINE WITH EIGHT DOORS



A new eight-door stationary-fixture finishing machine designed primarily for coloring of aluminum castings has been announced.

The new machine has a door on each flat of a single compartment cylinder. Fixture pads are attached to the octagon side walls of the compartment just inside the door opening.

Fixtures are in the form of grids which fit attached pads. After the fixture is placed inside the cylinder, it is held in position during the processing operation by the pads and by pressure of the closed door pushing it firmly into the contoured pad.

It is reported that one of the outstanding features of the machine is that it is not necessary to remove processing media or solution when removing the work load from the compartment.

Roto-Finish Co.
For more information, circle No. 206 on the Reader Service Card

FOUR STATION VACUUM GAUGE FOR CONTINUOUS READING

A new one to four-station vacuum gage which gives continuous pressure readings from 100 mm Hg to 1 micron (0.001 mm) Hg, is being made available in this country. The gage is manufactured in Sweden.

The new unit, called Autovac, is a self-balancing, direct-reading, hot-wire type of vacuum gage. It is said to provide a higher degree of calibration stability than any other instrument of its type.

Outstanding feature reported for the instrument is its automatic switching from the mm range to the micron range; a special range selection circuit is used to do this. A red light indicates when the instrument is in the mm range.

The gage circuit contains a resistance-bridge circuit fed from an 800 cps oscillator. The wire of the gage tube forms one of the branches of the bridge. The bridge is in balance when the temperature of the wire is about 12-C. Any change in pressure in the tube will cause a change of the wire temperature and consequently of the wire resistance, and the bridge will thus become unbalanced.

Consolidated Vacuum Corp.
For more information, circle No. 207 on the Reader Service Card

METAL DEGASSING UNITS
. . . assure sounder castings

A vacuum unit designed specifically for rapid and efficient degassing of molten metals has been introduced. Vacuum degassing before pouring results in castings of higher quality, thus minimizing rejections. Gas removal allows considerable reduction or elimination of blow holes and porosity.

The units consist of a vacuum chamber, an air filter, a high capacity mechanical vacuum pump, vacuum and air inlet valves. The entire unit is mounted on a steel base.

The vacuum chamber is a stainless steel tank, provided with a Pyrex sight port for close observation of the melt during degassing. A Bourdon vacuum gage allows observation of pressure from zero to 30" of mercury. The chamber is provided with a counterpoise to make lifting easy and can be swung aside for complete access to the crucible.

Optical Film Engineering Co.
For more information, circle No. 209 on the Reader Service Card

FOUNDRY MOLD COMPOUNDS
. . . packed in polyethylene

One of the well known lines of foundry mudding and joint sealer compounds, permanent mold coatings and paste type core and mold coatings is now being packaged in polyethylene lined drums.

According to the manufacturer of the coatings, the new type of packaging has several advantages. Paste products are preserved indefinitely against drying out; the compounds can be kept cleaner; partly used drums of compound are protected against drying out; the containers do not rust; and there is less waste due to the compound sticking to the container.

Frederic B. Stevens, Inc.
For more information, circle No. 212 on the Reader Service Card

HIGH PRESSURE HOSE
. . . for heavy duty surge

The addition of a new, high pressure, flexible hose line, capable of withstanding unusually severe surge peaks in industrial hydraulic applications, has been announced.

The new hose, available in ⅜, ½ and ¾ inch sizes, will perform satisfactorily at 5,000 psi operating pressures in the ⅜" size and at proportionate pressures in the larger sizes. The two larger sizes use standard detachable, reusable fittings, while a special socket has been designed for the ⅜" hose line. Pressures 15 to 20 percent higher than any of the standard hoses can be safely handled.

Aeroquip Corp.
For more information, circle No. 211 on the Reader Service Card

TWO-TON PUNCH PRESS
. . . for production of experiment

A new, open-back inclinable punch press with a capacity of two tons has been introduced. The press is suited to small stampings not requiring a capacity of over two tons. On continuous production work, up to 250 piece per minute can be produced.

The press incorporates a number of time proven features, the frame can be easily tilted to any operating angle desired. In production work the press is said to be ideally suited to such work as stamping, shearing, forming, drawing, riveting, blanking, etc. It will work equally well on metals, plastics, textiles, fibre, leather, paper, etc.

Alva Allen Industries
For more information, circle No. 216 on the Reader Service Card

Convert your DRILL PRESS *into an Automatic !*

SINGLE OR MULTIPLE SPINDLE

SET RAPID APPROACH to any length up to 4" + stroke with rapid cycle dial. Saves time. Ideal for jig tumbling.

SET DRILLING SPEED to material hardness with Feed Valve Dial. Adjusts to an infinite range of speeds. Increases drill and tap life.

ADJUST DRILLING DEPTH to .002 plus or minus accuracy with micrometer type Depth Dial.

MANUAL LEVER CAN BE USED ANYTIME for manual drilling or guiding in jig tumbling.

FOR DRILLING • TAPPING • REAMING • THREADING
COUNTER BORING • SPINNING • SPOT FACING • FLY CUTTING

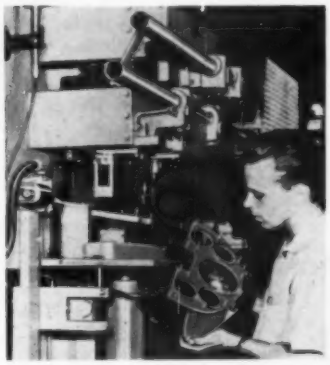
AIR OPERATED AND HYDRAULICALLY CONTROLLED, the General Automatic Drill Feed is a precision instrument. Carries warrantee of parts. Has operated continuously for over 10 years without replacement of parts. Hand and foot pedal release provide dual safety factor. Write for complete facts and new reduced prices to General-Pacific Corporation, 8740 Washington Blvd., Culver City, California.

GENERAL AIR OPERATED-HYDRAULIC CONTROLLED
Multi-Speed DRILL FEED

For more information circle No. 62 on the Reader Service Card

AUTOMATIC UNIT DRIVES STUDS IN DIE CASTINGS

A multiple station, hopper-fed automatic stud driving machine capable of processing 600 parts per hour has been developed and production-tested over the past three years and is now in production.



Designed specifically for high speed driving of studs into die castings, these units can insert studs into cored holes at compound angles without tapping. The use of plastic fixtures prevents marring of surfaces. The automatic drive chuck holds studs securely without thread damage.

When stud driving, hoppers supply studs automatically to the specially-designed automatic release chucks. The chuck then drives the stud to the desired depth at the desired angle. Precision, uniformity and high production rate, plus low maintenance, are claimed on the basis of several production installations.

Positioning of the hydraulic power cylinder can be either vertical or horizontal, to eliminate interference with the operation of the spindles. Accurate holding fixtures can be built or repaired in a few hours. According to the manufacturer, fixtures in service on a 3-spindle operation have produced more than 50,000 pieces without repair or maintenance.

Studrive, Inc.
For more information, circle No. 220 on the Reader Service Card

SET DESIGN ENGINEERING SHOW FOR MAY

The first Design Engineering Show, will be held at Convention Hall, Philadelphia, May 14 to 17, 1956.

Exhibits will include parts, components, finishes and basic materials, as well as testing machines, x-ray machines and other equipment with specific design engineering applications.

a special message for appliance manufacturers
need a finish that blocks corrosion by itself—or under paint?
specify IRIDITE

You can solve any problem of non-ferrous finishing . . . maximum corrosion protection . . . sparkling clear or colored decorative finishes, firm and lasting base for paint . . . with these two words—"specify Iridite". For example—

- **ON ZINC AND CADMIUM** you can get highly corrosion resistant finishes to meet any military or civilian specifications and ranging in appearance from olive drab through sparkling bright and dyed colors.
- **ON COPPER . . .** Iridite brightens copper, keeps it tarnish-free; also lets you drastically cut the cost of copper-chrome plating by reducing the need for buffing.
- **ON ALUMINUM** Iridite gives you a choice of natural aluminum, a golden yellow or dye colored finishes. No special racks. No high temperatures. No long immersion. Process in bulk.
- **ON MAGNESIUM** Iridite provides a highly protective film in deepening shades of brown. No boiling, elaborate cleaning or long immersions.

AND IRIDITE IS EASY TO APPLY. Goes on at room temperature by dip, brush or spray. No electrolysis. No special equipment. No exhausts. No specially trained operators. Single dip for basic coatings. Double dip for dye colors. The protective Iridite coating is not a superimposed film, cannot flake, chip or peel.

WANT TO KNOW MORE? We'll gladly treat samples or send you complete data. Write direct or call in your Iridite Field Engineer. He's listed under "Plating Supplies" in your classified telephone book.

ALLIED RESEARCH PRODUCTS
INCORPORATED
4004-06 E. MONUMENT STREET • BALTIMORE 5, MD.

Manufacturers of Iridite Finishes for Corrosion Protection and Paint Systems on Non-Ferrous Metals, ARP Plating Chemicals.

For more information circle No. 58 on the Reader Service Card

USEFUL LITERATURE CATALOGS, MANUALS

to get any of the free materials described here, circle the appropriate number on the reader service cards bound into this issue

PROCESSES

Casting Metals: 154
Three brochures from Howard Foundries briefly describe the facilities available for making castings in both ferrous and non-ferrous metals.

Shell Mold Castings: 155
A six page brochure published by the Central Foundry Div. of General Motors Corp. describes the shell mold casting process. Included are numerous examples of parts cast by this process.

Investment Casting: 156
How to evaluate investment casting as a manufacturing method, and how to properly design for investment casting by machining small numbers of polystyrene patterns for test castings is told in a brochure from Precision Metalsmiths, Inc.

Powdered Metal Parts: 157
The application of powder metallurgy to the production of high strength structural parts is told in a brochure from American Sintael Corp.

The Mercast Process: 158
What the Mercast process is, how it should be used, and where it should be used is told in a brochure and a group of pamphlets available from Alloy Precision Casting Co. which produces castings by this process.

Modern Die Casting: 159
The Dollin Corp. has published a new brochure on its modern, high speed die casting procedures. All of the facilities of the plant from initial estimating to machining the finished casting are fully described and illustrated.

Vacuum Casting: 160
A four page brochure on vacuum casting in plaster molds has been prepared by the Universal Casting Corp. A wide variety of impeller wheels that have been cast by this process are illustrated. A second brochure describes the process of plaster mold casting, its applications, the metals that can be cast, etc.

Castability: 161
Engineered Precision Casting Co. has prepared a 24 page booklet on castability, its effect on alloy selection for the investment casting process. The text covers all factors in the investment casting of metals that are a function of the alloy.

Die Castings: 162
A four page brochure has been prepared by the Doehler-Jarvis Div. of National Lead Co. that illustrates a few of many complex die castings currently helping to lower production costs on both consumer and industrial goods.

Castings in Shell Molds: 163
The Curtis Wright Corp., Metals Processing Div., now fully equipped to produce castings in ferrous base metals by shell mold, centrifugal, and sand mold methods, shows these facilities in a brochure. Typical castable alloys are given with their chemistry and physical properties.

Electroforming: 164
Some of the possibilities and the advantages of making parts by electroforming are described and illustrated in a leaflet from Bart Laboratories Co., Inc.

MATERIALS AND EQUIPMENT

Induction Melting: 166
Ajax Engineering Corp., has released a 4 page folder describing the characteristics and operation of a new combination induction melting and holding furnace and automatic pouring unit.

Metalworking Presses: 167
Bulletin 3201, recently published by Baldwin-Lima-Hamilton Corp., illustrates and describes the company's line of metalworking presses for extrusion, forming and drawing, forging, bonding, etc.

Automatic Gravity Casting: 168
A fully illustrated information package published by Automation-Engineering Corp. describes and illustrates the automatic gravity pouring and casting machines built by the company.

High Vacuum Pumps: 169
Mechanical pumps for the rapid evacuation of vessels and for backing-up diffusion pumps are described in a folder from the Kinney Mfg. Div., New York Air Brake Co.

Casting Alloys: 170
A group of brochures published by the Geo. Sall Metals Co., Inc. give the properties, uses, machining, etc. of some copper base and aluminum base alloys.

Small Die Casting Machines: 171
In a 4 page brochure, American Die Casting Machinery Co. has described its 60 and 80 ton die casting machines, both hot and cold chamber.

Metallurgy Wall Chart: 172
An 8½ x 11 wall chart of basic metallurgy is now available from the Tempil Corp. The chart gives the principal characteristics of carbon steels (up to 0.90% carbon). Major working zones are shown.

Photoelectric Pyrometer: 173
A 4 page bulletin issued by Photoswitch Div., Electronics Corp. of America describes the new photoelectric pyrometer for temperature measurements in the range of 1000 to 5000F. The instrument is said to have a sensitivity of 5 deg. F.

Spectrographer's News Letter: 174
In a quarterly, external house organ the Applied Research Laboratories publish news of new methods, new equipment and other items of interest to the practicing spectrographer.

For Die Designers: 175
Detroit Mold Engineering has an external house organ, DME News, in which information of value to the designer of die casting dies is regularly published.

Continued on page 78

HONITE Barrel Finishing Produces

Superfine Sanitary Finish!

Cherry-Burrell Corporation, Milwaukee Division, made large savings when they switched to the HONITE Barrel Finishing Method, *and* actually improved the sanitary finish necessary on their line of food processing equipment.

The milk filler tank shown below was formerly finished in two hand operations—grinding to remove weld splatter and generally improve the surface, and polishing to bring the surface down to 15 R.M.S. Recently, Methods Engineer, Ralph Wenger, supervised a change to the HONITE Barrel Finishing Method.

Results? The recommended HONITE procedure eliminated the polishing operation completely, and 60% of the rough grinding hand operation. Finishing time was cut 1½ hours . . . and finishes were improved to a superfine finish.

Your HONITE Methods Engineer or nearby HONITE distributor will show you how *you* can increase production and cut costs, too. Call him today!

Remember, too, the HONITE Division of the 3M Company supplies a *complete line* of abrasive chips, compounds and equipment for every barrel finishing need.

CHERRY-BURRELL METHODS ENGINEER, Ralph Wenger, holds a 40 lb. stainless steel milk filler tank. HONITE Barrel Finishing Method produced its superfine finish.

Honite BRAND

IT'S NEW!

Made in U.S.A. by Minnesota Mining and Mfg. Co., General Offices: St. Paul 6, Minn. In Canada: P. O. Box 757, London, Ontario. Export Sales Office: 99 Park Ave., New York City. Makers of "SCOTCH" Pressure-Sensitive Tapes, "SCOTCH" Brand Magnetic Tape, "3M" Adhesives, "Underseal" Rubberized Coating, "Scotchlite" Reflective Sheeting, "Safety-Walk" Non-slip Surfacing.

3M

MINNESOTA MINING AND MFG. CO.
DEPT. FF-125, ST. PAUL 6, MINN.

☐ *Send me FREE copy of "Facts and Figures Report on HONITE Barrel Finishing"*

☐ *I'd like to talk with a HONITE Field Engineer*

Name ..... *Title* .....

Company .....

Address .....

City ..... *Zone* ... *State* .....

Type of product to be finished .....

For more information circle No. 63 on the Reader Service Card

WHAT'S THE BEST WAY TO STRIP METAL PARTS IN LARGE VOLUME?

See page 9

Are you looking for better methods for stripping paint?

Do some finishes resist your present stripping methods? Do rejects pile up and cause a bottleneck in your production line? Do you have trou ripping vertical surfaces of large products?

Oakite's FREE bookle " to STRIP PAINT" will help you fi nt procedures. You'll want to read m out.

¶ What's the best way to strip paint from metal parts too large to be soaked in tanks? *See page 3.*

¶ What's the best way to strip large areas of structural metal where a steam supply is available? *See page 5.* Where steam is not available? *See page 7.*

¶ What are the best ways to prepare stripped metal for repainting? *See page 11.*

¶ What strippers are best for removing oil-base paints? . . . Synthetic enamels, alkali-resistant plastics or resin-based paints? . . . Japans, wrinkle finishes, nitrocellulose lacquers, alkyds, phenolics and ureas? *See page 12.*

FREE For your copy of "How to STRIP PAINT" just write or mail the coupon.

Technical Service Representatives in Principal Cities of U. S. and Canada

OAKITE

MATERIALS · METHODS · SERVICE

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34G Rector St., New York 6, N. Y.

Send me a FREE copy of "How to STRIP PAINT"

Name_____

Company_____

Address_____

For more information circle No. 67 on the Reader Service Card

Useful Literature — Cont.

Waterless Hand Cleaner: 176
Lanolin fortified skin protective films and skin cleaners are described in literature available from The Chemical Corp.

Magnesium: 177
What magnesium is, what it will do, how to use it and other questions are answered in a brochure published by the Magnesium Association.

Hardness Conversion: 178
A handy hardness conversion chart, applicable to steels, has been published by The Babcock & Wilcox Co. Conversions are from Scleroscope to Brinell, Monotron and Vickers hardness. Another conversion table gives the conversion from Rockwell hardness to approximate tensile strength.

Powdered Metals: 179
The production and utilization of metal powders, particularly iron powder, is thoroughly covered in an 11 page brochure published by the Plastic Metals Div., National-U.S. Radiator Corp.

Tool Steels: 180
The first edition of the "Free Machining Tool and High Speed Mailer" has been issued by Allegheny Ludlum Steel Corp. The mailer gives information on analyses, red hardness, abrasion resistance, etc. of the company's tool and high speed steels.

Small Ingots of Special Alloys: 181
A new metal service inaugurated by the Allied Products Div. of the Hamilton Watch Company will produce small ingots (10 lbs.) of special metals and alloys to meet close specifications. Also included in the new service will be the fabricating, rolling, heat treating and finishing of special alloys. Both regular and vacuum melting are employed in producing ingot. A 16-page booklet just released describes the facilities available.

Molten Metal Purification: 182
Fluxes and molten metal purifiers to insure sound castings, eliminate undesirable gases, and provide sound welding of inserts into the castings, when desired, are fully described in literature published by Pittsburgh Metals Purifying Co.

FINISHING

Cleaning Manual: 183
A new manual on industrial cleaning equipment and materials entitled "How To Select The Proper Method, Machine and Material" has been published by Magnus Chemical Co., Inc.

Drill Units: 184
A 4 page brochure from Dumore Precision Tools describes the Dumore Automatic Drill Units. Case histories of production cost savings with these units are given.

Evaporated Films: 185
An engineering report on evaporated films for optical goods has been prepared by Optical Film Engineering Co.

Micro-Drills: 186
A brochure published by Louis Levin & Son, Inc. lists all of the drills, both right hand and left hand, and the center drills made by that company. Small precision drill presses are also shown.

Liquid Filters: 187
Six new catalog sheets on Sel-Rex Filters for liquid clarification or solids recovery have been issued by Bart-Messing Corp.

Barrel Finishing: 188
Four new brochures on barrel finishing from heavy deburring and cutting to burnishing and cleaning have been issued by Newton Industries, Inc.

Cutting Coolant: 189
Complete data and instructions for use of a new water soluble cutting coolant, Hypercut XX, have been published by Destiny Products Co.

AUTOMOTIVE TURBINES
continued from page 58

he added that its cost is too high and either the cost of the casting method must be reduced, or it must be re-designed.

The one final casting, of importance and relatively large size, that he mentioned is the *bearing casing*. At the present time this is a nodular iron casting with quite thin wall sections. In an effort to reduce the weight of this part, even thinner sections are being contemplated. While it is not proposed that an investment casting procedure is desirable here, other accurate molding methods, perhaps shell molding, will be required to achieve weight reduction, he commented.

Any consideration of castings also means consideration of the alloys used, Dr. Frey indicated. For reasons of cost and availability new blading, nozzle and turbine rotor casting alloys are being developed for automotive turbine use. Most of these will have to be iron base, with no cobalt and a minimum of nickel in the austenitic alloys! Austenitic alloys appear necessary in such parts as compressor turbine blading or radial inflow expellers, low alloy cast ferritic materials are satisfactory for power turbine stages, either in the blades or in an all cast structure.

ALCALOY BUYS BETA ALLOYS

Beta Alloys Co. of Trenton, N. J., has been purchased by Alcaloy, Inc., of Trenton, according to James W. Dickey, president of Dickey Industries. All of the equipment and personnel of Beta Alloys Company have been transferred to the new ownership, a move which will enable the combined organization to increase production and expand product lines.

Alcaloy, Inc., manufacturer of permanent mold castings from a special alloy metal, is associated with Dickey Industries. Other associated companies are: Dynotron Corp.; Ohio Hoist & Mfg. Co., Inc.; Desco Corp.; Educational Devices, Inc.; and Porta-Play, Inc. Dickey Industries is headquartered at 13111 Shaker Square, Cleveland 20, Ohio.

"we started using HOUGHTO-SAFE after this fire!"

Section of fire-ravaged foundry where a hydraulic oil leak proved costly.

"Putting off installation of *Houghto-Safe fire-resistant hydraulic fluid* cost us this disaster which could have been prevented", says the owner, sending us this picture.

There's a happy sequel to this story:

Just a few weeks after the costly fire, a similar break in their hydraulic oil line occurred. This time the machine operator was drenched . . . but only with *Houghto-Safe!* No ill effects. No damage. *And no fire!*

Houghto-Safe, the fire-resistant hydraulic fluid developed in Houghton laboratories, is not only fire resistant but also non-corrosive, non-toxic and safe for hydraulic equipment, packings and personnel!

HOW SAFE IS YOUR PLANT?

Why not talk to the Houghton Man about Houghto-Safe benefits *before* a costly fire that may also cost lives! Or write for latest Houghto-Safe bulletin to E. F. Houghton & Co., 303 W. Lehigh Ave., Philadelphia 33, Pa.

HOUGHTO-SAFE

. . . a product of E. F. HOUGHTON & CO.
PHILADELPHIA · CHICAGO · DETROIT · SAN FRANCISCO

Ready to give you on-the-job service . . .

For more information circle No. 72 on the Reader Service Card

READ THIS

and increase your die casting machine production

Precision

UN-BREAKABLE
tempered and treated stainless steel die casting

PLUNGER RINGS

give up to

8 to 10 TIMES THE AVERAGE LIFE

of

Die Casting Plunger Rings

Name the largest die casters and you will have the users of Precision Un-Breakable Tempered and Treated Stainless Steel Die Casting Plunger Rings. The reasons are many . . . here are a few.

1. Precision Die Casting Rings are wrought, **not cast**, from dense, fine grain, flawless stainless steel.
2. They are formed to have uniform tension throughout the entire circumference.
3. They have flexibility and resiliency . . . yet withstand excessive temperatures without collapsing.
4. Special heat treatment processes give Rockwell C-48-55 hardness, yet . . . rings remain un-breakable.
5. Precision Rings are available specifically for die casting machines in various widths to suit your present and proposed plunger grooves.
6. They are engineered to let the ring take the load of sealing and maintaining pressure.

Precision's Engineering Department can solve your problems on die casting . . . increase machine productivity through longer ring life . . . reduce rejections and operating costs.

Write today for our recommendations on rings for your die casting plungers.

Precision PISTON RINGS, INC.

1317-1325 COMMERCE AVENUE INDIANAPOLIS 1, INDIANA

Sales Offices: INDIANAPOLIS—CHICAGO—LOS ANGELES—SAN FRANCISCO—NEW YORK—PHILADELPHIA

Circle No. 46 on the Reader Service Card

LONG LIFE
continued from page 48

the total cycle is not particularly rapid, the portion of the cycle where the paper is stipped from the impression cylinder is extremely rapid.

Because of the need for high acceleration, the part must be of low mass and this has been obtained by first desigining for minimum tolerable sections and the use of aluminum as a construction material. In this case, the desired design of the part and production quantity indicated die casting as the most economical method of manufacture.

The final die casting, Figure 3d, illustrated is the body of an air valve. Three of these bodies are used per press and the zinc die casting represents a conversion from the original cast iron body.

This casting has a bronze bushing cast-in as an insert. This bushing is machined from stock by the Miller Printing Machinery Co. and the outside is knurled to lock it securely into the casting. The casting contains seven cored holes of which five are located so as to intersect the bronze bushing.

After casting, the bushing must have two grooves machined in it to give the proper valve functions and all holes are reamed and where necessary tapped.

Naturally, this casting must be non-porous and to insure both adequate thread engagement and air tightness at cored holes, all critical parts have bosses cast on to insure adequate seal.

CLOSE SYMMETRY
continued from page 46

—with practically none of the disadvantages. All structural details, such as the guide grooves and the hanger, are cast in and with sufficient accuracy so that no further machining needs to be done other than to remove traces of flash. Generally, passing a file through the grooves is sufficient.

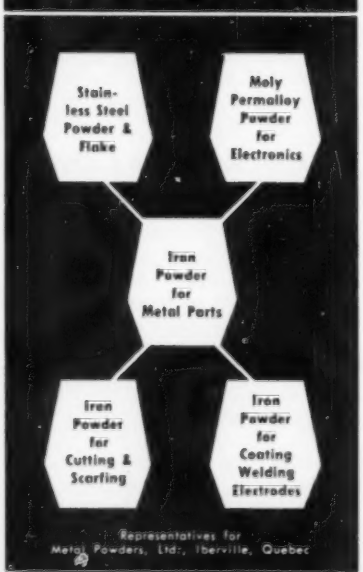
The face angles "a" can be cast to tolerance since the two halves of the shell mold do not permit any mold shift during the casting operation. The superior surface finish that is characteristic of a shell mold casting makes finish grinding comparatively light and only rarely are defects that could cause rejection uncovered during this grinding operation.

Since the guide grooves are cast to finished size and location, the first operation of milling these guides is eliminated as is the holding fixture. This results in a lower cost, holding fixture.

In those cases where a plain carbon steel wedge gate is used, the wearing surfaces are generally hard faced with Stellite. The facing is applied by one of the standard techniques using a Stellite* rod and gas welding. After application of the hard facing, the wedge is ground. In this case, all of the savings that are noted above are effected. The hard facing is applied to the casting as it is received from the foundry and the only machining that is then required is surface grinding of the wedge faces.

* Registered trade mark, Union Carbide & Carbon Corp.

METAL POWDERS


Stainless Steel Powder & Flake
Moly Permalloy Powder for Electronics
Iron Powder for Metal Parts
Iron Powder for Cutting & Scarfing
Iron Powder for Coating Welding Electrodes

Representatives for Metal Powders, Ltd., Iberville, Quebec

mpa METAL POWDER ASSOCIATION

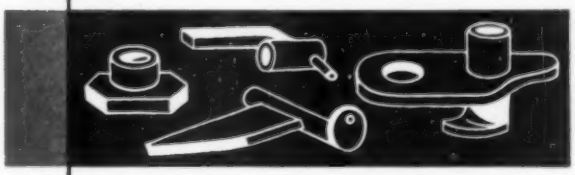
MICRONIZED METALS, INC.,
38-13 TENTH STREET
LONG ISLAND CITY 1, N. Y.

Circle No. 40 on the Reader Service Card

for better investment castings

Petrolite casting waxes

PC·13
PC·44



These Petrolite waxes, especially developed for investment casting, have all of the desirable qualities required for pattern waxes. They are hard and tough, without being brittle. They have wide solidification ranges. They can be blended to give any desired injection temperature.

These Petrolite casting waxes are suitable for use in either metal or plastic molds. They give patterns which are free from flow line defects due to rapid cooling. While these Petrolite waxes can be blended for special applications, either will, in itself, provide superior melting, solidification and molding characteristics.

these characteristics tell the story

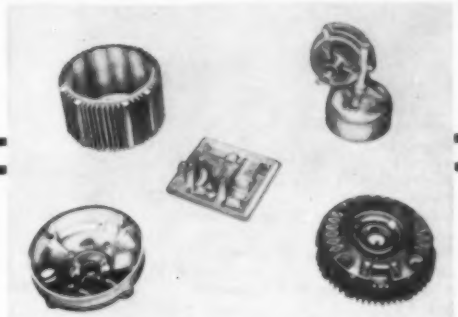
	PC-13	PC-44
Melting Point, Ring and Ball	190-195°F	165-175°F
Solidification Point	160-170°F	140-145°F
Injection Temperature	200°F	140-180°F

Petrolite Casting Waxes are ready for prompt delivery at all times. They are packaged in 100 pound cartons, containing 8 slabs per carton. They are stocked at and available for shipment from Jersey City, Chicago, Los Angeles, or the Petrolite refinery at Kilgore, Texas. Samples and technical data are available on request – at no obligation.

PETROLITE CORPORATION
WAX DIVISION
Chrysler Building, New York 17, N.Y. • P. O. Box 390, Kilgore, Texas
PC-13-44

For more information circle No. 47 on the Reader Service Card

A Designer's Dreams Can Be Materialized with Die Castings of Aluminum and Magnesium Alloys



For Example: In the Electrical Equipment Industry (and no stranger to every form of industry) is the die cast part made from the new lightweight magnesium and aluminum alloys. Every year has witnessed wider and wider acceptance of these tough and strong metals. Designers have found them adaptable to such an important degree that many of their creations have been successfully die cast where formerly other methods forbade their development. In this electrical equipment industry, vital usage is made of these parts die cast from aluminum and magnesium. The illustration above shows a few—electrical windshield wiper housing, electronics hose part, motor and bells and a motor field ring. Features that make these die cast parts practical include great cost savings through the virtual elimination of machining and finishing while at the same time maintaining precision standards. Tough and strong, the alloys have the dimensional stability required for maintaining bearing fits and tolerances. Parts such as these give adequate dissipation of heat through their high thermal-conductivity as compared to other materials. With the freedom of design permitted, greater scope is allowed the designer to easily add such features as heat dissipating fins.

Let's Talk It Over . . .

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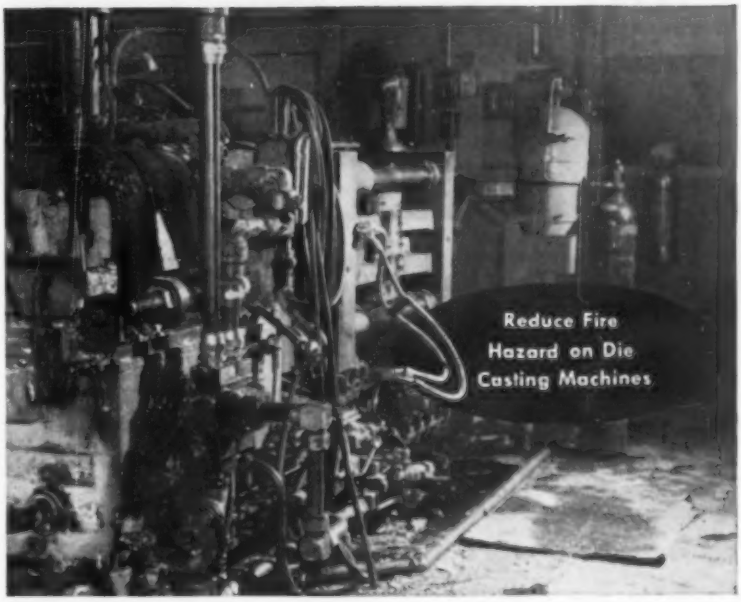

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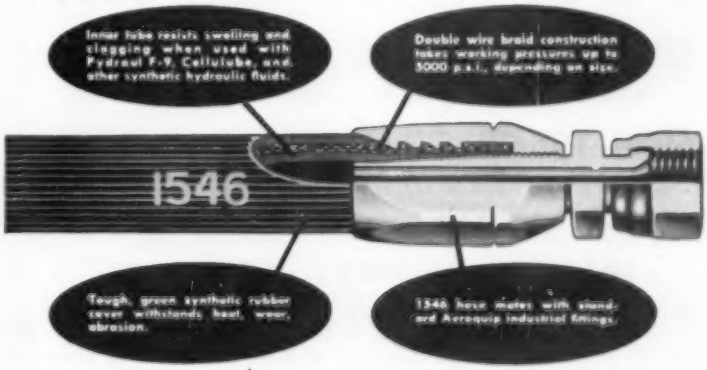
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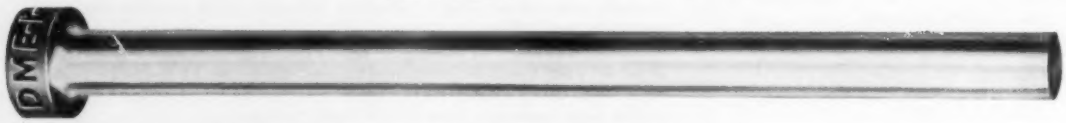

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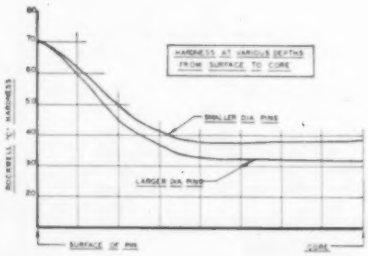

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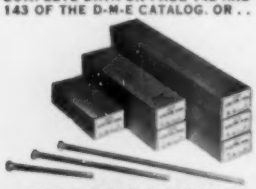

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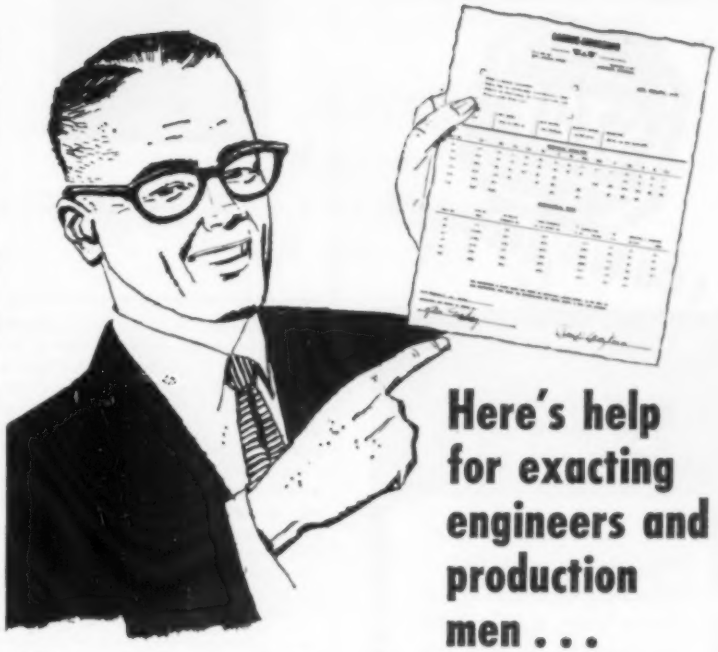

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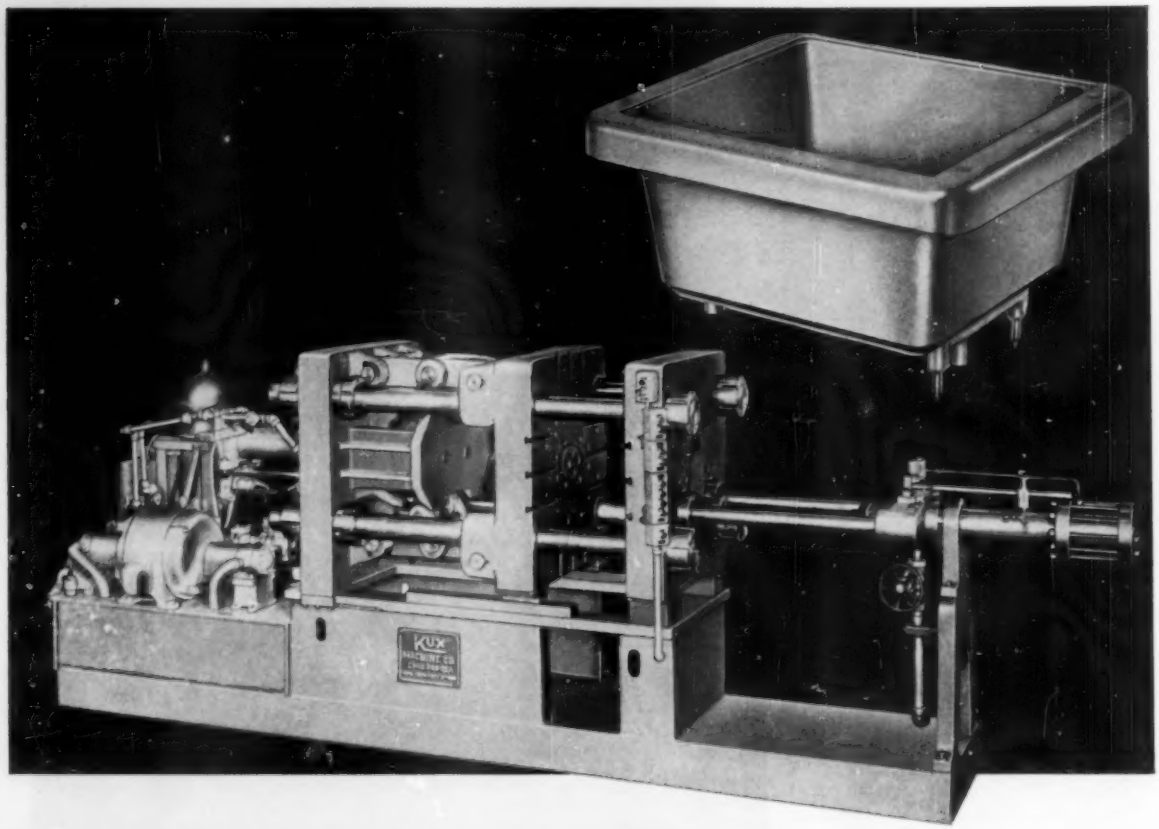
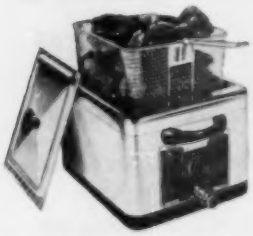


to get hardware finish quality castings with cast-in heating elements **EASTERN METAL PRODUCTS** *chose...*



KUX DIE CASTING MACHINES

for the Alcamatic Cooker and Deep Fry

"The die-cast well is the heart of our ALCAMATIC Cooker and Deep Fry and naturally must be of top-quality construction," says Mr. Seymour Troy, executive vice-president of Eastern Metal Products Corp., Tuckahoe, N.Y.

"The use of KUX machines (3 in the Forth Smith, Ark., plant and 4 in our Tuckahoe factory), plus our own production processing, enables us to provide the finest aluminum well, making the product an excellent working unit as well as an attractive appliance.

"KUX machines make the difficult problem of cast-in Calrod heating elements easy," Mr. Troy says, "plus cutting our production costs considerably.

"The hardware finish quality castings provided by KUX machines eliminates many polishing and finishing operations and leaves the fry well easy for the housewife to clean."

For the manufacture of electrical appliances requiring dense hardware finish quality castings, KUX die casting machines are unexcelled. Write for our NEW illustrated catalog.

MODEL HP-37 ILLUSTRATED

Hydraulically operated die casting machine for production of aluminum castings.

KUX MACHINE CO. 6725 NORTH RIDGE AVENUE • CHICAGO 26, ILLINOIS

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NEWS OF INDUSTRY AND ASSOCIATIONS

ACCURATE DIE CASTING NAMES VICE-PRESIDENTS

The promotion of Harold E. Schlenker and John W. Vanek to vice-presidents of Accurate Die Casting Company, 3089 East 80th Street, Cleveland has been announced by M. N. Suvak, company president.

H. E. Schlenker J. W. Vanek

Schlenker, who joined Accurate in 1947 as a salesman, has been appointed vice-president in charge of sales and will direct all sales and customer relations activities. He attended Fenn College and during the war served as ensign in the Naval Air Force.

Vanek's duties in his new position as vice-president in charge of engineering will be to supervise the research, design and new development activities of the firm. Vanek attended Fenn College and has had 15 years of die casting experience. He joined Accurate in 1945 and has until now been chief engineer.

ADD SHELL MOLD CASTING

The Aurora Metal Company, Aurora, Illinois has expanded its production facilities to include a complete line of copper base shell mold castings. Fully automatic equipment will accommodate parts up to 20" x 30" pattern size. This firm also offers complete engineering, metallurgical, pattern making, and finish machining facilities.

PRECISION CASTINGS TO SPEND $1,250,000 FOR EXPANSION PROGRAM

Precision Castings Company expansion and facilities improvement program at Fayetteville and Syracuse plants will involve expenditures of $1,250,000 before next Summer, William J. During, president, has revealed.

The program is expected to add substantially to the local work force, probably several hundred employees.

Precision, merged with Harrisburg Steel Corporation in July, operates plants in several cities and is a major die casting concern.

Included is the former Bradley Hammer plant, 402 N. Franklin Street. Here $350,000 of the appropriation will be spent on new castings and plating equipment.

A new Fayetteville plant on Route 5, just east of the rail-

Continued next page

INVESTMENT CASTERS ELECT

Members of the Investment Casting Institute, shown above as they met in Detroit Nov. 1-3 for technical and business sessions, have elected the officers and directors shown at left. They are, l. to r., R. S. Banister, Midwest Foundry Co. (VP); W. A. Dubovick, Engineered Precision Casting Co.; K. W. Thompson, K. W. Thompson Tool Co.; H. Dolan, executive director; V. Lazzaro, Casting Engineers, Inc. (Pres.); T. Operhall, Misco Precision Casting Co.; P. W. Schipper, Howard Foundry Co.; A. C. Williams, Crucible Steel Company of America; R. Miller, Precision Metalsmiths; and W. L. Worthen, Bone Engineering Co.

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Oil Absorption (G & C) 36.4 to 40.3 lbs.

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New improved equipment assures highest quality and production control.

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road crossing, was built several years ago. These facilities will be practically doubled, Mr. During said.

There are older facilities at Fayetteville, including a magnesium foundry building for World War II defense production work.

Mr. During said improvements of other Precision plants are being examined into as part of Harrisburg Steel's program for total modernization and highest efficiency of operations.

NEW HOME FOR MARVEL ENGINEERING

Marvel Engineering Company, designers and manufacturers of Marvel Synclinal Filters have moved to their own, recently completed plant at 7227 N. Hamlin Ave., Chicago 45, Ill.

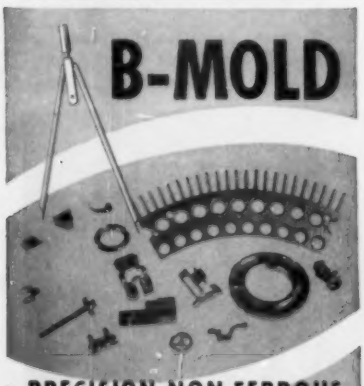
The one story building, of modern construction and design is situated on the company's grounds in such a way as to allow for further expansion when necessary. Plant layout and production lines are geared to greater efficiency and all shipments will continue to be made immediately if required, or as specified.

DIE CASTING ENGINEERS NAME DETROIT OFFICERS

Results of the mid-summer mail-ballot election have been announced by the Eastern Michigan (Detroit) chapter of The Society of Die Casting Engineers.

Officers for the calendar year 1956 are: chairman, John Lapin, chief die casting engineer for Saginaw Bay Industries in Bay City, Michigan; vice-chairman, Marshall Aberle, chief die casting engineer for H & M Industries, Inc., of Flat Rock, Michigan; secretary-treasurer, Louis Draves, process engineer with Ternstedt Division of General Motors Corporation in Flint; librarian-historian, Frank S. Marra of Detroit Mold Engineering Company in Detroit; trustee, Harry D. Hirsch, president of C. M. Hall Lamp Company of Detroit.

Lapin, the new chairman, has been recording secretary during 1955; Aberle repeats as vice-chairman. All others elected have not held office before, but have been active in Society affairs. H. W. Roushkolb of Cleveland Automatic Machine Co. and John L. Miller of H & M Industries,



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STROH DIE MOULDED CASTING CO.

525 East Michigan St., Milwaukee 2, Wisconsin

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Inc., continue as trustees. Trustees are elected for a term of three years.

The Eastern Michigan chapter was the first to be organized when The Society of Die Casting Engineers was formed October 4, 1954. Growth has been rapid; the Society currently lists 274 paid members. A second chapter, the Western Michigan chapter, was recently formed in Grand Rapids, Michigan.

BROOKS ADDRESSES ASTE

A detailed discussion of the investment casting process, by Louis E. Brooks, general manager of Jelrus Precision Casting Corp., New York, and a director of the Investment Casting Institute, highlighted a recent meeting of the Potomac Chapter of the American Society of Tool Engineers, Washington.

Brooks' talk covered the subject of "Jelrus Precision Investment Casting" beginning with the history of investment casting and continuing with the modern development of the process, methods used, size and types of castings, materials, tolerances, finish and costs.

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In 15 years several hundred thousand Remington Typewriters have been built on bases die-cast by The Hoover Company. As with many other leading American manufacturers, Remington Rand has found that die-cast parts mean faster, simpler assembly, improved product appearance and strength with elimination of dead weight.

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The Hoover Company
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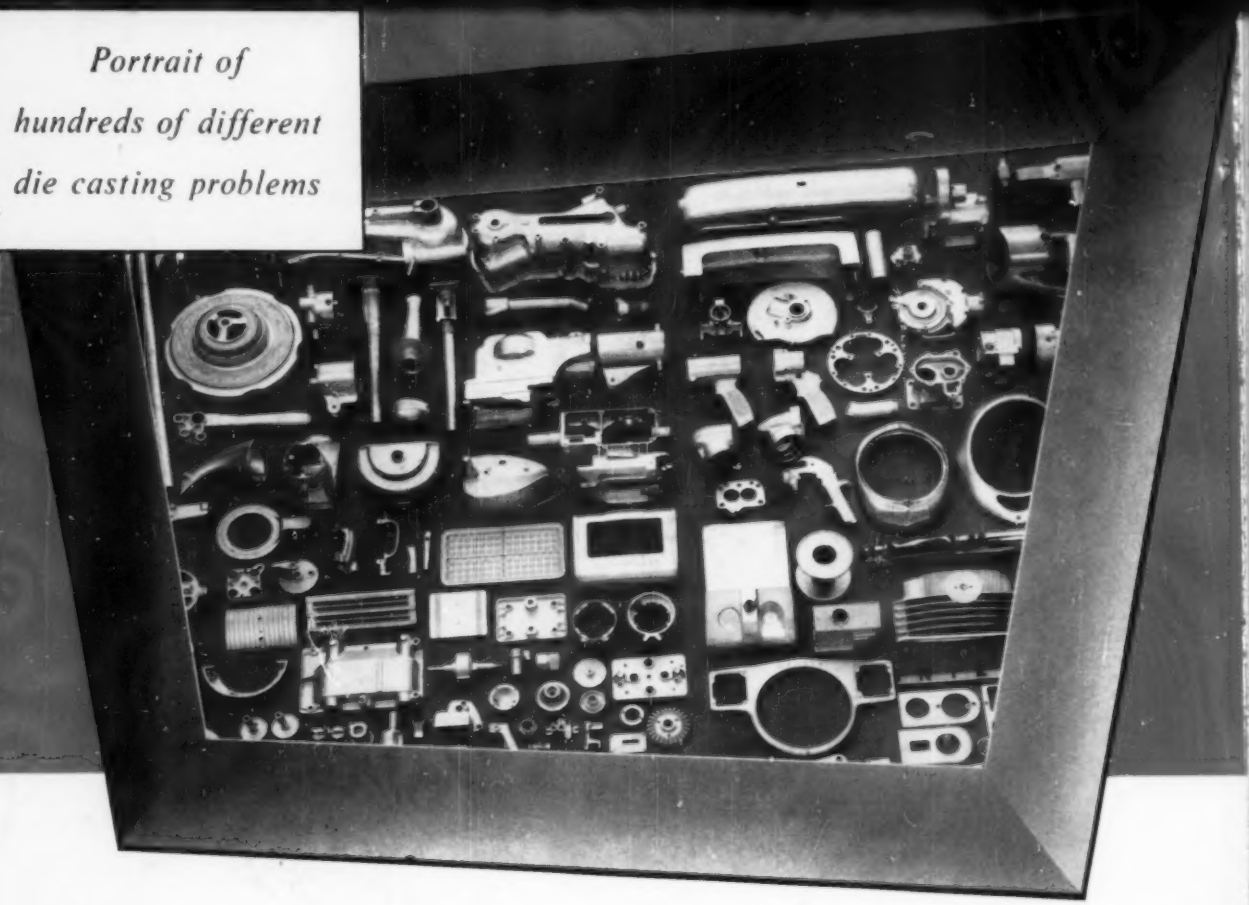
Portrait of hundreds of different die casting problems



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Send for our helpful booklet, "Die Casting Alloys." Shows composition, properties, other data on Apex products. No obligation.

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